THE CONTROL OF THE CIRCULATION

FREDERICK ERDMAN

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BY PHYSIOLOGICAL METHODS

FREDERICK ERDMAN

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TO MY PARENTS,

TO WHOSE DEVOTION AND
CHRISTIAN FAITH,
I OWE SO MUCH

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PREFACE

The publication of the following treatise, describing the system of spinal therapy practiced by the author, has been undertaken upon the urgent request of a number of friends in the medical profession, as well as of many others who have experienced the benefits of the application of the principles herein set forth. It is not the author's intention to question the cures obtained by any other system of spinal treatment, but rather to indicate certain fundamental physiological principles which explain the effects of all spinal applications and to prescribe certain definite rules and warnings essential to the successful treatment of the most sensitive and critical conditions.

The methods described and the conclusions reached are the result of more than fifteen years of continuous and careful application to numerous pathological conditions of a physiological law utilized and communicated to the author by the late J. P. Arnold, M. D. This law, which the author accepted as a working hypothesis, is the existence of a compensatory balance between the circulation of the blood in the spinal cord and in the spinal muscles innervated by the posterior primary divisions of the spinal nerves.

Except for this working principle and the quotations from Dr. J. P. Arnold, the author must assume responsibility for all the statements, including the Rules for Treatment, herein contained.

The clinical results and daily observation during fifteen years of painstaking work along the lines indicated have adequately confirmed the sufficiency of the working hypothesis, and the increasingly uniform results, which have been obtained as the result of experience in the practical application of the principle, should be of interest to all who are desirous of relieving human suffering.

Many fundamental statements, quotations, and references have been included herein for the benefit of those who have not had a medical education, but who will desire to understand the anatomical and physiological facts involved in intelligent spinal treatment. The author has endeavored to combine in a single volume such information as will enable the layman to apply to some extent the principles of this system of treatment in the home, with merely sufficient technical discussion to facilitate an appreciation by physicians of the principles underlying the theory and its practical application.

Separate books for technical and non-technical (lay) readers were considered, but the present form of the book, in simple language with certain limited technical references, was decided upon as best meeting the purposes contemplated.

Since it is rather late in the history of the healing art for anyone to claim to have devised any new method of spinal manipulation, it will be obvious that the successful results obtained by the author have not been produced by any new or arbitrary method of spinal *manipulation,* but by the *recognition* of certain physiological principles which, whether recognized or not, are involved in any system of therapeutics. The author, by means of careful tests of the blood pressure and pulse and of changes in nervous irritability, has classified the variations from the normal arterial circulation, and has herein endeavored to give such directions as will enable others with certainty to modify favorably the anemias and hyperemias of the spinal cord until the normal circulation is reestablished.

He hopes to prove also that the production of these immediate and definite vasomotor changes, by proper treatment for each spinal segment, has produced satisfactory therapeutic results because the method met the pathological requirements.

If a man is suffering or dying from extreme arterial hypotension, with a great variety of possible symptoms, any system of spinal manipulation will be absolutely injurious, no matter how extraordinary its title or theories; whereas a cold application merely sprayed on the spine may be sufficient to overcome the hypotension and start a recovery.

The effects on the circulation which may be produced by any physical treatment are limited. One can only correct or aggravate any existing disturbance in some balance of the circulation. This book is a discussion of the effects produced on the body by any treatment, rather than an emphasis on any particular instrument or tool used. It is largely a matter of choice whether one uses thermal, electric, chemical, or manual methods. In any case arterial hypotension requires exactly opposite treatment from hypertension.

Therapeutics has been so largely empirical that the narration of "cures," however extraordinary, will fail to interest a large class. However, the most conservative cannot fail to see the great diagnostic as well as therapeutic possibilities in being able, with regularity and precision, by proper treatment of certain spinal nerves, to liberate gas from the stomach and note the immediate change in blood pressure and pulse, and, subsequently, in other symptoms; in being able to restore to normal the peristaltic and vasomotor disturbance in diarrhea; to relieve pains from indigestion or cramps from cold in any voluntary muscle; to relieve with certainty the pain of acute attacks of sciatica and neuritis or neuralgia in other nerves; to diminish or increase throbbing in particular arteries; to bring to normal the blood pressure in many conditions, frequently raising the pressure 40 mm. Hg. or lowering it as much as 75 mm. by proper spinal treatment, with restoration of health.

The fact that the author has principles to suggest which explain the physiological action of most spinal applications and which explain the failures as well as the successes of many empirical therapeutic procedures, ought not to make the subject less interesting.

Some men even object to the use of the word "cure," as if that were claiming too much, and all we could expect of a physician was the prevention of disease and helpful advice about diet, exercise, climate, and the like. However, if as a result of chill, a man has a headache, a stomach ache, or neuritis, and treatment will entirely relieve all the symptoms, objective and subjective, "while you wait," it is not a misuse of the term to

call the result a "cure," especially if this has been done for a number of years and can always be done with regularity and precision in all similar conditions.

Further, if a man has a chronic tendency to headache, stomach ache, or neuritis, and the reestablishment of the normal circulation in each spinal segment, by one or a number of treatments, until the general and local circulation remain stable, causes the chronic pain and other symptoms to disappear, we may properly apply the word "cure" to the proceeding; especially if it can be done with regularity in all similar conditions.

Certainly an ever-increasing number of people can relieve themselves and others with precision of a great variety of acute attacks, as for example, headache, indigestion, neuritis, and diarrhea, and control the action of the bowels, even after twenty years of constipation.

The question naturally arises as to whether the effect of the treatment will last. Just as an individual may be built up by a generous diet, so the individual cell may be restored to normal health and activity by restoration of its normal blood supply. The health of the cell, as of the individual, will continue until subjected to some undue strain. The strongest organism gives out if subjected to excessive fatigue or cold, which are predisposing causes of most ailments, except those due to accidents and infections.

It is hoped that the publicity thus given the methods which have proved so successful will greatly extend the benefits which may be derived from an exact system of therapeutics of the circulation.

FREDERICK ERDMAN.

THE CONTROL OF THE CIRCULATION

CHAPTER I

THE CONTROL OF THE CIRCULATION

Standard medical textbooks, manuals of medicine, volumes on nervous and mental diseases, gynecologies, and volumes on diagnosis and surgery, as well as books on massage, hydro-, electro-, and mechanotherapy, mention the existence of sore spots in the spinal muscles occurring coincidently with a great variety of internal disturbances. For example, Butler's "Diagnostics of Internal Medicine" mentions some forty conditions in which these sensitive spots occur. In 1898, Hilton, in "Rest and Pain," wrote as follows:

> Indeed, I think I might generalize on this part of my subject, and make an artificial division of the back into three compartments. First, high up between the shoulders, where persistent pains—pains of nervous continuity—as a rule co-exist with disease of the heart, aneurism of the aorta, diseases of the bifurcation of trachea and bronchi, diseased glands, or stricture of œsophagus within the posterior mediastinum. Second, between the middle and lower part of the scapulæ and a little lower down, where the existence of like pains is most frequently associated with disease in the abdominal digestive viscera, through the medium of the great splanchnic and the intercostal nerves (I believe I have seen some cases of disease of the transverse colon where the patients have had those lower interscapular pains). Third, the surface of the lumbar region where the pains are most distinctly associated with local disease in the loins, such as disease of the ascending and descending colon, the kidneys, ureters, and lumbar lymphatic glands.

This law is mentioned also in Landois's "Physiology" (p. 934). "In the presence of painful affections in the intestines, pains appear in distant parts of the skin, supplied by nerves from the same level of the spinal cord, into which also the sensory visceral nerve enters. In the same category is the familiar occurrence of pains in the left arm in connection with

heart disease. Analogous conditions prevail in the head and the neck."

Similarly a great many standard textbooks recommend various forms of spinal counterirritation for the relief of various internal or external disturbances, *e.g.*, Allen Starr in "Nervous Diseases, Organic and Functional," 1907 (p. 653), recommends a mild mustard application for the acute stage of infantile paralysis. He says also in regard to the "referred pains," many of which occur along the spine:

> Not infrequently sharp counterirritation over the seat of pain is followed, not only by a relief of pain, but also by improvement in the visceral condition which is its cause.
>
> Wet cupping over the kidneys in acute nephritis and over the back in suffocative bronchitis is sometimes attended with marked amelioration of the symptoms.—Lauder-Brunton, p. 177.

To show how long and successfully spinal applications have been used by the laity, I would refer to "Papers on Health," by Kirk, an Edinburgh professor, published thirty years ago. Professor Kirk successfully employed spinal applications for a great variety of conditions.

In view of the wide use of spinal treatment by leaders of the medical profession, as well as by the laity, and the drugless systems of therapeutics, there is obviously no opportunity for anyone belonging to any school of therapeutics to question the possibility of effecting some internal disturbances by means of spinal applications.

It is entirely a question of how, where, when, and why to make spinal applications.

There are a number of well-recognized compensatory balances in the circulation of the body, *e.g.*, when the blood vessels of the skin are dilated the kidneys are less active because less blood passes through them; if the abdominal vessels dilate sufficiently, the circulation is slower through the brain. Similarly, when the blood vessels of the spinal muscles dilate or contract there must be a compensatory change in some other area of the body. That this area comprises the blood vessels of the spinal cord is the hypothesis which will explain all physiological treat-

ment of the spine. The writer is indebted to the late J. P. Arnold, M. D., for this hypothesis. It is the explanation of the action of the spinal pack given by Kellogg in "Hydrotherapy," 1903, p. 840: "The spinal pack produces first strong fluxion of the spinal vessels, later hyperemia of the skin, whereby the spinal cord is drained." The physiological law forming the basis of the author's system of therapy, and underlying all the effects of spinal treatment, is mentioned, but also questioned, in "Spondylotherapy," 1910, p. 72, Abrams, and is quoted also in "Mechanical Vibration," 1912, p. 145, Snow.

Arnold found that "repeated brief pressure along the spinal column arouses the reflex constrictor nerves and brings about a certain amount of contraction in the blood vessels of the skin and muscles of the back in the region of the back treated. It also undoubtedly produced at the same time a certain amount of dilatation of the vessels in the cord. On the other hand continuous pressure along the spine arouses the reflex dilators and brings about a certain amount of dilatation of the blood vessels in the skin and muscles of the back, and a corresponding contraction of the blood vessels in the cord," and therefore "there exists a compensatory relationship between the blood vessels of the cord and those structures supplied by the posterior primary divisions of the spinal nerves."

Although these writers thus give Dr. Arnold the historical priority in the matter, his principle is apparently not applied systematically in any publication which the writer has seen, perhaps because of the fact, mentioned by Abrams in the pages cited, that hyperesthesia (oversensitiveness) of the spinal muscles may be due to intrinsic changes in the sensory nerve cells in the cord. These two facts of physiology are, however, in no way contradictory, because if treatment which exactly reestablishes the normal circulation in a particular spinal segment relieves the sensitiveness immediately, it proves at once the truth of Dr. Arnold's principle in that case, but even if it is necessary to maintain the normal circulation for some time before the sensitiveness disappears, the same law is true. In other words, excessive irritability (unless organic deterioration

exists) of nerve cells, whether sensory or motor, will be steadily reduced if the normal rate of flow of the blood is carefully maintained. If the cells are only slightly irritable, a single treatment, if it perfectly restores the circulation, may cure the sensory or motor disturbances; if the cells are exquisitely irritable the normal rate of flow of the blood must be maintained for a proportionately longer time.

If the tenderness of the spinal muscles has come with some temporary acute attack, the tenderness disappears as soon as the circulatory equilibrium is reestablished, because the cells are strong enough to resume their normal activity as soon as the normal vital conditions are reestablished.

If the tenderness is chronic, the circulation must be maintained at normal until the nerve cells have gradually lost their excessive irritability. This is the fundamental difference between the acute and chronic attacks of any disease, as neuritis, rheumatism, or any functional or digestive disturbance. The degree of irritability of some nerve cells changes during every treatment. When beginning a treatment to relieve an acute abdominal cramp, for example, if more than the lightest possible spinal pressure is given, the cramp may be increased, but as the irritability diminishes, much harder pressure can and must be given to relax the cramp entirely.

If a man faints from anemia of the brain or is delirious or insensible from congestion of the brain, it is commonly recognized that, whether the cause be physical or mental, thermal, mechanical, or infectious, the most important move to be made is the immediate relief of the anemia or congestion of the brain.

It is not, however, so generally recognized that if a lesser degree of anemia or hyperemia of the brain so irritates certain nerve cells as to develop gradually in the patient symptoms of depression, insanity, or some other "nervous" trouble, it is just as important to correct this partial anemia or hyperemia.

This law is just as true of any segment or half segment as of the whole spinal cord. Variations in the blood supply to the controlling spinal segment occur with every pathological condition, however small the area of the body involved. These varia-

tions are necessary, inevitable, coincident, and, far more often than is suspected, the cause of the tissue changes and symptoms in the area of the body which the spinal segment controls.

This is proved by the improvement and recovery of local areas after the blood supply to the spinal cord is exactly re-established, and also by the fact that any symptom can be immediately aggravated by disturbing still more the already disturbed circulation in the controlling spinal segment.

The foregoing statements are all in harmony with the conclusions of Virchow, Verworn, and others, in regard to the cellular structure of the body and the nature of disease. Virchow demonstrated that the body is a community of cells. He and other physiologists, Verworn, for example, have reduced disease to the fundamental conception of the degree of irritability of these separate cells; primarily, of course, of those nerve cells in the spinal cord and brain which directly or indirectly control the activity of all other cells in the body.

By means of cell pathology, Virchow has laid the foundations upon which our modern medical attitude is built and which must remain essentially forever the basis of all future medical thought.—Max Verworn in "Irritability," 1913, p. 16.

Rudolph Virchow, after the establishment of the cell doctrine, arrived at the momentous conclusion that disease must be considered as reactions of the body cells to stimuli.—p. 10.

Stimulus is every alteration in the external vital conditions.—p. 37.

Disease is nothing else but reaction to stimulation.—p. 61.

By irritability Virchow understands "a property of the cells, by virtue of which they are set into activity, when affected by external influences."

The normal irritability depends on the maintenance of certain vital factors.

Disease is life under altered vital conditions and altered vital conditions are stimuli. This simple and self-evident fact shows the immense importance which the knowledge of the general laws of the physiology of stimulation has for pathology. The pathologist who does not wish to confine his observations to a purely superficial symptomatology or a merely histological morphology, must seek above all to penetrate as deeply as possible into the nature of the general reactions to stimulation in the living organism.—p. 76.

Obviously, the normal rate of flow of blood of a normal quality represents the normal external vital conditions for all the nerve cells in the spinal cord and brain and these nerve cells control the functions and nutrition of every tissue in the body.

In other words, as Landois says: "The irritability of the spinal cord depends on the maintenance of the normal circulation."

Therapeutics, therefore, should consist in the attempt to restore as perfectly as possible all the vital factors on which the life, health, and recovery of the controlling cells depend. The attempts to restore the vital conditions by control of rest, diet, and exercise are successful just in so far as they restore the vital conditions. The introduction of foreign substances into the circulation to affect the quality of the blood does not necessarily restore all the vital conditions.

Just as testing the blood pressure is gradually becoming recognized as a consideration of importance in prescribing medicine, and since the prescribing of medicines without blood pressure tests has always been and always will be empiricism, so also (in view of the fact that the pulse and blood pressure test, if rightly understood, is an absolute factor in determining the kind and amount of treatment for any spinal segment) all general routine treatment, whether electrical, hydropathic, or manual, if given without careful and systematic blood pressure, pulse and other tests, is as unscientific as the similar indiscriminate use of drugs.

The symptoms of anemia or hyperemia of the brain are familiar to all. If a man has fainted, the simple act of getting more blood to the head, by means of gravitation, makes a change from apparent death to life. Since nerve cells in the brain, whose activity was suspended during the faint, will resume their normal function as soon as they receive their normal circulatory requirements, should it be considered incredible, if a treatment which relieves anemia or hyperemia of part or all of the spinal cord should produce some less extraordinary changes in the activity of the nerve cells in the spinal cord and the functions thereby controlled?

The familiar and beneficial effects of massaging muscle masses will not be discussed in this book. In Lauder-Brunton's "Therapeutics of the Circulation," these effects are simply and graphically described. General massage is, however, often inadvisable and, if applied to the spinal muscles, is oftener injurious and frequently dangerous; whereas, any pathological condition whatever will be favorably affected if the vascular condition of the body in general, and of each spinal segment in particular, can be altered toward the normal. It is a most obvious generalization from all cases treated, as well as a most rational supposition, that the chance of recovery from any pathological condition, whether acute or chronic, whether local or general, other factors being equal, is better when the rate of flow of the blood is brought as near as possible to normal.

Swedish movements are valuable for certain conditions in which it is desirable to accelerate the lymphatic circulation so as to relieve the infiltration of the tissues. For various reasons, however, the writer has confined his treatment to the spine; partly because he wished to introduce only one factor at a time, so as to demonstrate the nervous control of conditions usually treated locally. If vasomotor disturbances are properly readjusted, the excess of lymph is rapidly carried away, and the effects of local manipulations can usually be only accessory and temporary. The writer does not wish, however, to undervalue the remarkable results which have been accomplished by osteopaths, bonesetters, and others, by means of local manipulations and passive movements, and by the readjusting of dislocated bones in the ankle and other joints; conditions which had not been relieved by the most experienced surgeons.

In this connection it may be added that exclusive spinal treatment for "tennis leg" and for chronic flexion of the knee joint has proved that these conditions may be entirely the result of irritability of the controlling nerve centers. Pressure on sacral nerves has at once relaxed muscles in the leg which had been contracted for years. The beneficial effects of massaging are too well known to require mention, but if the patient's blood

pressure is low or the nerves very irritable, "massage" of the spine may be very injurious.

> Massage of a considerable muscular area produces a fall of general arterial pressure, in consequence of the derivation of blood into the dilated muscular vessels. This fall may amount to one fifth of the initial pressure.—Shafer, p. 155.

For many people, especially the weak, this fall is injurious, and if prolonged, the harm will outweigh the benefit of the temporary acceleration of the circulation.

Further, since stimulation of a nerve produces more or less fatigue, it is usually better to rely on the spinal treatment which is far more effective and important, and on those movements which produce the greatest effects upon the large lymphatics with the least fatigue. Irritability, whether mental or muscular, is a sign of fatigue of the nerve centers; therefore we should avoid increasing the fatigue by too much massage, and every stimulation of a sensory nerve adds to its fatigue. Abdominal massage would be injurious for a patient with relaxed abdominal vessels and consequent chronic or acute cerebral anemia. It may also be distinctly injurious to cause pain by local massage of any sensitive part, as for neuralgia, or neuritis.

Any kind of manipulation of the skeletal muscles accelerates the circulation, at least temporarily, with more or less benefit or injury, but since the treatment under discussion could not mechanically affect the circulation, except in certain spinal muscles, and since the treatment is usually very light, the exact and powerful effects produced in the body can be explained only as the result of modifying the circulation to the controlling nerve cells in the cord and brain. Many of the exact and delicate circulatory and other changes produced in this way would be modified, destroyed, or at least obscured, and therefore ignored, by anyone giving any form of massage, or "readjustment" treatment, or any of the violent but commonly used forms of counterirritation, whether thermal, electrical, or mechanical.

Starting with the demonstrable proposition that the nutrition, irritability, and normal functional activity of nerve cells

depends upon a uniform rate of blood flow, and being able, usually beforehand, to determine the kind and amount of treatment required for each case, in order to bring the blood pressure and pulse to or at least toward normal, and being able to verify the results mechanically, this form of treatment can claim to have satisfied the requirements essential to a recognition of its scientific basis.

The results of vibrating and massaging muscle masses by mechanical means are too well known to be discussed, but the same principles are involved by whatever agencies or methods the spine is treated and no one would think of depending exclusively upon the use of any instrument for spinal treatment, or on any general application after having once seen the results sometimes obtained by simple pressure, on a muscle fiber no longer than the width of a finger tip, and having observed that any similar pressure on any other part of the spinal muscles may produce an injurious anemia of the cord.

Powerful pressure or counterirritation of any kind is dangerous if the nerves are irritable; even wearing a little plaster on the skin may be sufficiently irritating to raise an already high blood pressure.

This treatment must, therefore, not be confused with massage; massage is never prescribed for acute conditions, whereas proper spinal treatment is just as useful in acute as in chronic troubles.

Since many obvious cures are being produced by large numbers of people using different forms of spinal treatment having more or less extraordinary titles (osteopathy, naprapathy, spondylotherapy, chiropractic, etc.), all having more or less mutually destructive explanations of their *modus operandi,* there must be some other common explanation which can account for the results produced. Their "mental effect" can account for only a limited number of cures and therefore as an explanation is inadequate, easily disproved, and betrays an absolute ignorance of the exactly opposite effects which can be produced in the circulation at any one time by giving the right or wrong treatment. Excepting obvious dislocations, all of

these systems of treatment do most obviously affect the blood supply of the spinal cord and brain, as well as the rest of the body, and a more exact knowledge of the circulation will not only explain all the cures obtained by the different methods, but will enable one to get more exact and uniform therapeutic results.

All of the chronic invalids who have consulted the writer had been living, sometimes for years, either with extreme relaxation or excessive contraction of some of the abdominal vessels or visceral muscles. Contracting the relaxed blood vessels of those with low blood pressure (hypotension), and relaxing the contracted vessels of those with high blood pressure (hypertension), and producing these changes only where they were required, have produced results which necessarily can never be produced by any form of general treatment.

Any number of different symptoms may result from a starvation of the nerve cells in the cord and brain. Since any fact in the universe may be "taken hold of by two handles"—and with most men "if they have a theory the facts will take care of themselves"—each of these symptoms is likely to be treated as a separate disease, or others will try to prove that any one of these symptoms is the cause of any or all of the nine hundred and ninety-nine other symptoms. But when symptoms can be immediately aggravated by increasing the anemia of the cord, and when these symptoms occur as acute attacks and can be immediately diminished or gradually cured by relieving the low tension, it would seem reasonable to suppose that these symptoms are the necessary *result* of the low tension.

Since high and low tension are due frequently to the weakness of certain segments only, it is obvious that no one depending on medication, or general treatment of any kind, could verify this law of physiology, especially when the lightest possible pressure of a finger on the spine with low blood pressure will only increase the hypotension.

While the absolute relation between the activity of nerve cells and the rapidity of their blood supply is most easily demonstrated with conditions following general hypotension, the same

law can be demonstrated with any condition of the circulation. This fact of physiology soon becomes as evident as the law of gravitation.

In view of all the effects which follow variations in the rate of the blood supply to the spinal cord and brain, and in view of all the symptoms and suffering that can be relieved by restoring the normal rate of blood flow, it would seem that we have, as Hilton quotes from Darwin in the conclusion of his "Rest and Pain," "a theory founded on nature that should bind together the scattered facts of medical knowledge and converge into one point of view the laws of organic life, which would thus on many accounts contribute to the interests of society and teach mankind in some important situations the knowledge of themselves."

CHAPTER II

THE HEALTH OF THE NERVES*

A Summary of the Factors Involved in Strengthening and Weakening the Nerves

Practically everyone is familiar with the fact that the human body is a collection of cells and that the nerve cells in the spinal cord directly or indirectly control the nutrition, growth, and functional activity of all the other cells in the body. The chief characteristic of nerve cells is irritability. The physiologist, Landois, says that "the normal irritability of the spinal cord depends on the maintenance of the normal circulation." In other words, the maintenance of a certain rate of flow of the blood, of a normal quality, is one of the vital factors on which depend the health, functional activity, and also the recovery of all nerve cells, and incidentally of all the rest of the body.

There are other vital factors, as proper amounts of food, rest, and activity. In this chapter the author wishes to discuss the vital factors involved in weakening or strengthening nerve cells. The more carefully all the factors are considered, the more nearly can one understand all the good or bad effects on the body of exercise, food, rest, heat, cold, gravitation, diversion, excitement, indigestion, altitudes, and infections, and also understand the good and bad effects of all kinds of physical treatments.

If one carefully considers what is good for the separate nerve cells he can understand what is beneficial for the whole body. Since each nerve cell is living in a stream of lymph (a part of the blood) from which it derives its nourishment and into which it discharges its waste products, we can understand that excellent generalization of the English pathologist, Lazarus-Barlow,

* Copyright, 1918.

"Every pathological condition is fundamentally a nutritive one." Whatever, therefore, affects the quality or rapidity of flow of blood affects the health of the nerve cells either favorably or unfavorably. If the circulation is retarded, chemical or other tissue changes occur, even gangrene. Acceleration of the circulation would prevent these changes by carrying away the waste products, the "toxins," which would accumulate.

Heretofore almost all the attention has been paid to the quality of the blood. At present the rate of flow is also being considered, but chiefly by those giving physical rather than medical treatment. Since it may be assumed and also proved that the quality of the blood depends on its rate of flow through the tissues which manufacture its constituents, it follows that the rate is relatively a more fundamental consideration than the quality. The blood supply, and therefore the activity of the nerve cells in each spinal segment, can be separately affected by spinal treatment, and adjacent segments frequently require opposite kinds of treatment; therefore, all *general* attempts to affect the rate of flow of blood (hydropathic, electrical, mechanical, or medical) may fail entirely to restore the normal equilibrium in particular segments.

Just as the normal activity of every normal cell in the body, and in particular the activity of the controlling cells in the spinal cord, depends on the maintenance of the *nutrition of the cord and brain,* so also the restoration of functionally disturbed or diseased cells. Every treatment, therefore, of any kind whatever, if it is beneficial to a patient, must in some way directly or indirectly contribute to the restoration of one or more of these vital factors.

The normal rate of flow of the blood is the vital factor which the physician may control with the cooperation of the patient. In addition, if the patient is willing and able to take sufficient food and rest, any weak nerve cells may be strengthened with certainty. The patient may be unable to sleep or eat sufficiently, but the insomnia or indigestion disappears as the normal rate of blood flow in the brain and spinal cord is reestablished.

The one general law, that patients with relaxation of all the blood vessels (hypotension) and those with too much contraction of the blood vessels (hypertension) require exactly opposite treatment, is well understood even by all makers of blood pressure apparatus. This one law explains why so often in the past the same baths, the same exercise, the same mechanical treatment, have produced exactly opposite effects on otherwise *apparently* similar conditions, causing the intelligent public to conclude that all treatment is experimental.

If a man with low blood pressure (from relaxation of the arteries) is given hot baths or cathartics, the effect is gradually, and sometimes immediately, prostrating, whereas many men with high blood pressure would be benefited by the same procedures. A cool bath may be beneficial for a man with low blood pressure, but if the water is too cold or the arteries too much relaxed, the cold will drive the blood from the skin to the relaxed abdominal arteries and still farther lower the blood pressure.

When it is realized that each spinal segment may be affected oppositely from the next, and that even patients with high blood pressure may have areas of marked hypotension, it will be seen that there may be other, yet unrecognized, reasons why the same treatment produces opposite effects on apparently similar conditions.

Many similar facts may be stated which explain why the same treatment helps one patient and injures another. If any hydropathic, manual, or electrical treatment is so given that the circulation is better after treatment than before, no one could be worse for it, but a better circulation does not mean merely a temporarily accelerated flow produced by mechanically dilating the blood vessels of the muscles. Any form of treatment, or mental or physical work, may temporarily accelerate the blood flow through the brain and relieve many "mental" and physical symptoms, but for those with hypotension, unless these dilated vessels are contracted afterward to the normal caliber by the controlling vasoconstrictor nerve cells,

the rate of blood flow will be slower for an indefinite period after, and this leaves the nerve cells in the cord and brain with an impaired rate of income. In view of the great variety of treatments in the world, some with extraordinary names, most with some obvious "cures," there must be some common factors to explain the results. The "mental effect on the patient" is the usual explanation given. This explanation is weak, utterly inadequate, and disproved by the immediately wrong effects produced on the circulation if one makes a mistake in applying the powerful but painless methods advocated by the writer. There is surely a great need of some guiding principles to decide beforehand whether treatment will be beneficial or injurious to a particular patient or symptom.

The sources of nutrition or income of strength for the nerve cells in the brain and spinal cord may be reduced to three: (1) *Food* (including air) which provides the necessary constituents for furnishing energy and tissue-forming material for the cells; (2) the *Rate of Flow of the Blood,* which conveys the material to the cells; and (3) *Rest,* which represents the time required for the cells to recuperate. All are vital factors. If these can be maintained at normal, any weak nerve cells will recover with physical certainty. Of course, nothing can be done for dead nerves, but even with many conditions (*e.g.,* paralyses) where some cells are dead, the surrounding cells will recover if the normal circulation is reestablished.

First Vital Factor—Food

The first vital factor is *Food* (and fresh air). Some people who had weak nerve cells, because they were undernourished, have been cured by taking extra food, because thereby *the nutrition of the nervous system is improved.* Others who ate too much or indigestible food have been benefited by being put on a restricted or more digestible diet, largely because the acidity and flatulence of indigestion constantly disturbed the pulse and blood pressure. Thus by more care in eating, the rate of flow of the blood stream is brought to normal, and therefore *the nutrition of the nervous system is improved.* With

many patients, on account of its accelerating effect on the circulation, eating will relieve pain and nervous irritability. In others, with excessive flatulence or an irritable pylorus, eating will slow the circulation and increase nervous irritability.

Fresh air is included under the first vital factor, because it supplies material by which *the nutrition of the nervous system is improved.* The cells of the brain are particularly dependent on oxygenated blood, but if the attempt to get fresh air involves too great exposure to cold or dampness, the circulation may be so depressed that recovery is retarded or the health may even be seriously injured.

Second Vital Factor—Rate of Circulation

The normal *Rate of the Circulation* is the second vital factor. If this is sufficiently disturbed (*i.e.,* if any of the blood vessels are greatly relaxed, or if any large arteries are so much contracted that the heart cannot force the blood through them at the proper rate) no amount of extra food or rest will restore the strength of the nervous system. Rest and food, alone, will be sufficient to restore the normal circulation only in cases in which the fatigue, and consequent irritability of the vasomotor nerve cells, is not too great. Blood pressure tests do not indicate the rate of the circulation. A man may have a high blood pressure and be perfectly well as long as the heart is equal to the extra work and the tension of the arteries is uniform throughout the body. High pressure is, however, a menace because if any area is congested from cold, the high tension of the arteries in the rest of the body will force the blood into the local congestion. This is one reason why the most vigorous people have the most serious and sudden illnesses. It is a great mistake, however, to suppose that the resulting local congestion, acute or chronic disease of the kidneys, brain, or other tissue, is necessarily the cause of the high arterial tension. High tension can be immediately the result only of increased irritability of the vasomotor nerve cells which contract the muscular coats of the arteries. This increased irritability *may* be entirely the result of fatigue.

A rise or a fall in blood pressure may be the immediate result of the incarceration of gas in the stomach or intestine. Relaxing the pylorus (the exit of the stomach) has lowered the blood pressure immediately many millimeters (once 100 mm., usually much less), but with many people blood pressure is merely *gas pressure*. Gas is formed in everyone's stomach, the amount depending on the degree of hyperemia (acute or chronic dilatation of the blood vessels) in the walls of the stomach. The gas flows in a steady stream to the lowest part of the bowel, where it is rapidly reabsorbed. It causes discomfort, pain, or some degree of disturbance in the pulse or blood pressure, if the amount of gas is excessive, or if it cannot pass readily through the contracted pylorus or any intestinal ring. The formation of gas has no necessary connection with the food, but indigestible or too much food will irritate the stomach, dilate the blood vessels, and increase the amount of gas formed. Food may even flavor the gas, but most of the gas is not the result of fermentation of food, or of swallowing air, as is commonly supposed. One may nearly blow up with gas after an operation even if one has had almost nothing to eat for a week. Eating will often relieve gas pressure by starting peristaltic action and opening the pylorus. Whatever drives blood to the stomach, especially a sudden cooling of the skin, may cause any degree of flatulence. The discomfort of "intestinal indigestion" is due to the pressure of gas which is held in the intestine.

Exercise

Exercise is the usual means of accelerating and maintaining the normal rate of the circulation. Exercises, deep breathing, all forms of physical culture and out-of-door life have cured many persons because they all may accelerate the circulation, improve the appetite, digestion, and elimination, and increase the intake of oxygen and produce other effects, by all of which *the nutrition of the nervous system is improved.*

Exercise is beneficial and necessary, but even exercise involves an expenditure of nervous energy which represents a loss

like any other form of nervous expenditure. It is, however, the acceleration of the circulation, and therefore of the *rate of nutrition,* during and after the exercise, which is beneficial. Therefore the amount of exercise should be regulated according to the existing income of the patient. The energy expended represents an investment, the resulting improved nutrition represents the return on the investment. It is therefore easy, if one is weak, to make the expenditure exceed the return. If a patient has a low blood pressure (from hypotension), he should not be advised to take long walks, because this, or any other overexertion, lowers the blood pressure still more; and lying down may lower it still further, so that, even if he sleeps well, the rate of income of nutrition is so slow that the patient's vitality may be impaired instead of being increased by the exercise. The exercise should be brief, followed at once by rest in a recumbent position. This is also true when there is a limited abdominal area of low vascular tone. A man is only as strong as the nerves controlling his weakest blood vessels and if he exercises until these weakest abdominal blood vessels dilate from fatigue, the rate of flow of the blood through the spinal cord and brain is at once reduced and perhaps for an indefinite time after.

Even with a normal pulse and blood pressure, if the irritability of the nerves controlling the muscles of the stomach and intestines is excessive, any effort required either for mental or physical work may instantly increase this tension, and if the patient has any quantity of gas it may be so incarcerated as to cause any amount of cardiac or other disturbance. If the blood pressure is high, exercise within proper limits will reduce nervous irritability and relax the contracted muscles, but if the exercise is excessive it will afterward increase the irritability because of the slowing of the circulation as a result of the added fatigue of the vasomotor nerves and of the heart, which is working against an excessive internal resistance. Such questions can be decided accurately by testing frequently the pulse, blood pressure, and tension of voluntary and involuntary muscles. Guessing is inexcusable.

Physical Effects of Mental States

Cheerfulness, hope, a cessation of worry (whether the results of mental suggestion, or not), will power, faith in God, or even believing any comforting nonsense, pleasure, diversion, and even fright, because they powerfully affect the circulation, if they happen to affect the local cerebral or general circulation in the right direction, have cured many people because *the nutrition of the nervous system was improved.* Diversion to be beneficial must be taken out of working time. If it subtracts from one's sleeping time, it represents fatigue and loss of nutrition of the nervous system. For limited periods one may get along with less sleep by taking more food, because while the loss of sleep diminishes one's physiological income, the extra food may supply the deficiency, at the risk, however, of overworking the digestive apparatus; but to keep well one *must* live within one's physiological income in order to *maintain the nutrition of the nervous system.*

Other factors being the same, a manual laborer recovers more rapidly than a brain worker from any illness, because fatigued brain cells recover much more slowly than other nerve cells. Similarly a woman who does her own housework, other factors being equal, will recover from a given trouble more quickly than a woman who has fatigued her brain with mental work, social engagements, or any other forms of excitement. One may overwork for years before the increasing irritability of the nerve cells causes a high blood pressure, or some other serious trouble.

The nutrition of the central nervous system may be impaired or stopped by a mechanical injury, or growth, which of course must be treated surgically and locally. The local treatment, however, may never fully reestablish the delicate vasomotor balance which was disturbed by the injury and treatment may therefore be necessary to prevent the development of those functional disturbances which result from "delayed shock" or from the gradual starvation of nerve cells located in certain spinal segments only. Such gradual starvation of cells may not produce serious consequences until years afterward. In this

connection, it should be remembered that in all cases where people are unable to "throw off" some persistent cold or other disturbance, it is because the general circulation was depressed, usually through marked contraction or relaxation of abdominal and intestinal muscles and blood vessels. Similarly, the rate of accumulation or reabsorption of lymph in a tissue depends on the rate of the circulation.

Effect of Infections on the Circulation

Infections impair or destroy the nutrition of the body by disturbing the circulation, the second "vital factor," especially if the infection attacks the highly vascular spinal cord or brain. The effects of infections do not need at present to be emphasized, but as a rule, it is not sufficiently recognized, as Lauder-Brunton expresses it, that "Nothing predisposes more to the invasion of micro-organisms than chill," or in other words, it is the preceding disturbance in the circulation in the tissue, produced by cold, which affords entrance to the infection, or it is the low blood pressure, often from fatigue or from illness or injury, which lowers the resistance of the tissue to infection. It is the congestion of the mucous membrane of the nose and throat which furnishes the opening for many infections.

Consequently the expectation to cure all diseases caused by infection by using only the appropriate vaccine or serum is based on consideration of only the quality of the blood. The discovery of micro-organisms has done perhaps more than anything else to divert the attention of investigators from the study of pathological physiology of the circulatory system, because many men are perfectly satisfied that they have discovered the cause of congestion or inflammation and of nervous troubles, if they are so unfortunate as to discover some unwary micro-organism which has begun to multiply in some tissue with lowered resistance. People should realize that nervous fatigue, cold, excitement, indigestion, or mental and physical shock (even surgical) are the actual causes of many infections, and serums or vaccines alone can never reestablish the disturbance of circulation, which preceded and may follow indefinitely

both the infection and inoculation. No vaccine or serum can prevent the inevitable consequences of excessive fatigue or cold.

Attention has chiefly been centered on those causes which affect, or are supposed to affect, the quality of the blood, but many of these effects are actually due to the disturbance of *the rate of flow of the blood.* This is proved by the immediate changes produced by treatment which could affect only *the rate of flow of the blood.* Any chemical change in the tissues, even gangrene, may result from depression of *the rate of flow of the blood;* consequently it is not logical to attribute to auto-intoxication from the intestines or to uric acid or necessarily to any obvious infection, those chemical changes in tissues which inevitably follow any slowing of the *rate of blood flow.*

In any *chronic condition* the factors which disturb the circulation and aggravate existing conditions are usually limited to fatigue, heat, cold, gravitation, indigestion, excitement, traumatism, infection, the menses, and menopause. In the absence of organic changes, if one will try to keep fatigue within reasonable limits and will try to avoid cold, excitement, and indigestible food, treatment which carefully maintains the normal circulation in every part of the spinal cord and brain will strengthen weak nerve cells with physical certainty. Many satisfactory cures have been produced by efforts directed to control the food and rest factors, and often also to control the causes which disturb the circulation, *e.g.,* rest in bed which eliminates the effects of cold, fatigue, excitement, and gravitation. If, however, a man's blood pressure has fallen from fatigue, cold, excitement (including all kinds of shocks), or from physical injury or any serious illness, to 80 mm., eliminating the disturbing factors may be quite inadequate to bring relief if nothing is done to overcome the hypotension of the blood vessels. This is the condition of thousands of people suffering from a great variety of resulting symptoms; but all the attention is paid to the results of this starvation of the brain and cord. To make the very obvious but misleading remark that what helps one person does not help another, indicates a lack of knowledge of the physiological factors involved in the

weakening or strengthening of all nerve cells. It indicates an attitude of hopeless empiricism. The laws of physiology are the same in all human beings, but all the factors must be properly considered. Weak nerves are *always* benefited by *improving their nutrition.*

One may examine a patient most thoroughly, testing the secretions and the blood, using the X-ray, giving test meals, etc., but if there is a marked depression of the circulation to the cells in the spinal cord which control every tissue of the body, and nothing is done to reestablish the vital vascular circle, such an examination may be of no value whatever to the patient. Obviously, chemical and microscopic tests are most necessary for the detection of all kinds of infection, but if any existing circulatory disturbance is ignored no tissue has an opportunity to recover.

Degrees of Irritability

No one can uniformly affect the circulation favorably or advise the use of exercise, baths, or fresh air, if he does not recognize the extremely wide possible range of *degrees of nervous irritability,* and that nerves may become exquisitely sensitive to any form of stimulation, whether from changes in temperature, fatigue, excitement, indigestion, gravitation, or any form of mechanical, electrical, thermal, chemical, or psychic stimulation. Extreme sensitiveness to any form of stimulation is usually dismissed as "psychic" or "hysterical"; this is a fatal mistake, because the strongest man may have certain nerve cells which are as sensitive to any forms of stimulation as those of any hysterical patient, and all treatment or advice must be given so as to meet properly the condition of the weakest nerve cells. For example, disregard of the effects of the slightest temperature changes, as from draughts, provided the vasomotor nerves are extremely fatigued or weak, is responsible for the persistence of a great many chronic as well as fatal illnesses.

Diet Alone Inadequate

If a patient is suffering from an obviously retarded circulation, the most scientific dietary may be quite inadequate, be-

cause there is no properly circulating medium to convey the nutrition to the starved tissues. For this reason it is not difficult to understand why patients who have not been benefited by the most scientific dietary have begun to improve at once under the care of the writer when the normal vascular equilibrium in each spinal segment was established. The immediate improvement in many patients, as soon as the circulation was brought to normal, has made it evident that there are many other equally scientific forms of treatment which fail utterly, simply because the circulatory factor is ignored. Since one of the most common causes of a depressed circulation is the presence of incarcerated gas or acidity of the stomach, it follows that any diet that diminishes the amount of gas or acidity will to that extent benefit the patient, but it is the acceleration of the circulation, which is the medium for the nutrition of the tissues, which is commonly the cause of the benefit.

Physiological Treatments

Physiological treatments are the means by which the second "vital factor," the *Rate of the Circulation,* may be affected favorably or unfavorably. All forms of manual, mechanical, thermal, chemical, electrical, and even traumatic treatment which have cured people have done so because they have temporarily or permanently affected favorably this second vital factor, and therefore *the nutrition of the nervous system was improved.*

Since the nutrition and activity of all nerve cells are constantly and uniformly dependent only on the quality and quantity of the blood coming to them, it is at least certain that whenever these cells are weak, any treatment, to be beneficial, must in some way improve either the quality or the quantity of their blood supply. As already indicated, attention has been, and is, very largely confined to modifying the *quality* of the blood—in conjunction perhaps with very crude attempts to improve the rate of flow of the blood. Any treatment which can be proved by mechanical tests to have improved the pulse, to have brought blood pressure nearer to normal, and to have reduced excessive

irritability, is beyond question beneficial to anyone in any condition.

More careful study of the circulation will show that much of the treatment of the past by baths, exercise, massage, and even diets has actually disturbed instead of improved the rate of flow and therefore the nutrition of the nerve cell to be strengthened. The author believes that all forms of treatment should be so given as at least to affect the circulation favorably, whether the condition is entirely curable or not. Also that if the circulation is so affected the results will prove that any treatment, even including surgery, to be beneficial must in some way help to restore the normal *rate of flow* of blood to part or all of the body; further, that reestablishing this normal rate of flow is relatively more important in most conditions than attempts to modify the quality of the blood; and that the chemical changes in the blood and tissues are very often the result of the circulatory changes, and that even with micro-organisms present, it is just as necessary and important to reestablish the normal equilibrium of the circulation.

When people are cured by any system of *manipulation* which improves the circulation, it does not prove that it was the special movements or instrument with which the treatment was given, or the particular name of the system, or the theory in the mind of the operator which produced the cure; the patient was benefited by the temporary or permanent restoration of the *nutrition of the nervous system*. If a patient's blood pressure is 80 mm. and treatment brings it to 120 mm. the patient will be better whatever the name of the system. If the application of a little alcohol to the spine under proper conditions will accomplish this result most quickly, it proves that all the previous attempts at cure by forcible treatments or by diet, or by any other method, failed because they were inadequate and they were inadequate because they were based on some misconception. If a patient's blood pressure is lowered to 75 mm. by any treatment the patient will feel worse no matter what theory was in the mind of either the patient or the physician.

Why Many Forms of Treatment Fail

To summarize the history of all the cases of hypotension treated by the author, it is not surprising that the cases were not cured by any manual, medical, hydropathic, or electrical treatment which had increased and would increase any case of hypotension, as could have been determined if the tests had been applied. Neither is it surprising that any diet based on any theory had failed to benefit the patient, if the hypotension was unrelieved. *The author experimented nine years on himself before he learned how to overcome extreme hypotension.* Treatment which will relieve slight degrees of hypotension may only increase extreme hypotension. Mild degrees of hypotension may sometimes be gradually overcome by rest, nutrition, and moderate exercise, but as a rule hypotension is not regarded as the cause of nervous weakness, and yet it is *the one factor* which, being neglected, is responsible for all the failures, even of courses of treatment where all the other factors are carefully considered. The same is true of high blood pressure, which can be accurately relieved only when particular spinal segments are treated which are responsible for the contraction of the particular arteries.

A man's blood pressure may be 120 mm. and yet the lightest spinal treatment cause it to drop 20 to 40 mm. instantly. This shows an extreme tendency to hypotension, which a mere blood pressure test without knowledge of other facts would never determine.

All the cures which the writer has accomplished were entirely the result of maintaining as nearly as possible the three factors necessary to strengthen any or all weak nerve cells. In most cases, however, the most important factor, and the one previously either entirely ignored or most crudely treated, was the restoration of the normal rate of blood flow in each spinal segment. This normal rate depends on a vascular equilibrium, which is very sensitive even in health and extremely unstable locally or generally in all pathological conditions. Since the second factor absolutely essential to the recovery of weakened nerve cells is the restoration and maintenance of the normal

rate of blood flow, it is easy to understand why patients with low blood pressure are injured rather than benefited by hot baths, most forms of manual treatment, and much exercise or other fatigue. If the circulation is to be considered at all, it is obvious why nerve specialists protest against almost all operations on neurasthenics; for any abdominal operation must produce some degree of circulatory disturbance, either locally or generally; so that, even if a patient survives the original shock, the bad effects may appear years afterward when the spinal or cerebral centers reach a certain degree of starvation. It required nine years after an accident before the author's nerve centers gave out so that he could not sit up, and many chronic troubles with elderly people are only a result of a gradual, premature, and unnecessary starvation of nerve cells in some part of the spinal cord or brain.

A patient's history will often show that it was some severe illness (*e.g.*, a hard cold), a mental or physical shock, which started the disturbance in circulation resulting in the gradual starvation. Sometimes the patient with high arterial tension may for a time have the circulation favorably affected by an abdominal operation, or some violent form of spinal treatment, because the dilatation of abdominal vessels produced by the local or spinal traumatism lowers the resistance to the heart action. However, this is purely an accidental result and must ultimately cause other difficulties. Either hypertension or hypotension, even in *limited* parts of the arterial tree, *retards the rate of flow* of the blood and steadily starves out the cells in the spinal cord and brain.

The Excretory Functions

The excretory functions are vital, but the functions of all the excretory organs (kidneys, skin, lungs) depend on the *Rate of the Circulation* of the blood through them and this is controlled by the nerve cells in the spinal cord and brain. These processes, therefore, are part of the second vital factor—the *Rate of the Circulation.*

The secretion of any gland (*e.g.*, salivary or sweat glands)

depends on the amount of blood supplied to it, and this again is controlled by the nerve cells in the cord, and the activity of these cells depends on the second vital factor, the *Rate of the Circulation.* This is also true of the secretions of the ductless glands to which special study has recently been given. It is true that when a gland is congenitally too small, wonderful results have been obtained by feeding the patient on the extract of this gland from animals, and parts of the enlarged gland may need to be removed, but otherwise disturbed function means disturbed *Rate of the Circulation* in the controlling segments of the cord.

Time Required for Recovery

The rapidity with which any *local* tissue recovers depends on the stability and vigor of the general circulation and on the degree of starvation of the tissues; it is impossible to have a normal circulation in a local area if the main current is deficient. It is absurd to say "this treatment" of some local area, or "this medicine," will cure any particular disease, without regard to the degree of vasomotor fatigue or disturbance of the general circulation.

It is wrong to allow people to imagine that they can break physiological laws, expose the body to years of fatigue and cold which would injure a horse or a cow, and then expect that some special tonic, some mysterious prescription, some novel treatment, some surgical operation will remove the effects of broken physical laws and enable them to resume their life of overdoing, without sufficient sleep, exercise, or food.

The different vascular areas are in some degree separate and independent. Since the abdominal is the largest, and since fluctuation here affects the blood supply to every part of the spinal cord and brain, it follows that until this area is properly controlled, attempts to control the local vasomotor mechanisms, situated in the upper half of the dorsal region or in the sacral segments, may be futile. With the abdominal circulation disturbed, all local treatment of organs or tissues by specialists is of course proportionately futile.

Painful Treatment Injurious

Since pain increases the irritability of all the nerve centers and produces the most powerful local and general vasomotor disturbances, it is easy to see the reason why, for weak and sensitive patients, a great many alleged therapeutic procedures are useless or injurious. In view of the fact that in many conditions a few seconds of the lightest possible pressure on certain spinal nerves will produce the most powerful and beneficial results, whereas more pressure would be injurious, it is plain that much greater caution should be exercised by those using spinal vibrators and spinal massage, to say nothing of spinal cautery or concussion.

Since the nutrition of the spinal cord is the first consideration in all kinds of spinal treatment, *mechanical supports* not only may weaken muscles by depriving them of exercise, but the pain from pressure may seriously injure the patient's health and the steady pressure of some supports along the spine steadily increases the anemia of the cord. Even when mechanically indispensable, as for tubercular condition of the vertebræ, spinal supports are always physiologically undesirable.

Since *fatigue* is a common cause of excessive nervous irritability, if a patient has a high blood pressure with great tension of all the muscles and with frequent attacks of stiffness in muscles, following fatigue or cold, the condition should not be called "rheumatism" and the patient's most nourishing food withheld and more exercise prescribed. This impairs the nutrition of the nervous system in two ways—by starvation and fatigue. The tension of the muscles and the high blood pressure may be entirely the result of the irritability of the nerve centers, the result of fatigue, and the patient requires rest, nourishment, warmth, and perhaps treatment also, to lower the blood pressure to normal.

Altitude and Climate

A change of altitude or climate which powerfully affects the circulation, if it happens to be the proper change, has cured many people, because *the nutrition of the nervous system was*

improved. A patient with low blood pressure should not be sent to the seashore if it lowers the blood pressure still more. It may be absolutely prostrating. This is true of an altitude also, if the heart action is weak, but unless the heart action is very weak the altitude would be beneficial to a case of low blood pressure, because altitude raises the tension of at least the cutaneous vessels. Even if the blood pressure is somewhat above normal an altitude may be best for those with a loss of tone of the blood vessels of the *head.*

It is often observed that altitude does not raise the blood pressure; however, an altitude of even 2,000 feet for sensitive people does produce a marked contraction of the external vessels of the body. If the heart action is strong, this contraction of the cutaneous, and probably also of other vessels, does produce a rise in blood pressure. Certainly the resistance to the heart action is raised and the rate of flow of blood is retarded and any existing symptoms are aggravated in proportion to the retarding of the circulation and to the sensitiveness of the nerve cells in the spinal cord and brain. High altitudes are injurious or dangerous for anyone with high blood pressure.

Injurious Effects of Cold

The chief cause of disturbance in the circulation, and therefore of disturbance in every part of the body is the sudden cooling of the skin. Bulletins of the Department of Labor have warned workingmen that sudden cooling of the surface of the body, especially when one is warm, is the chief cause of pneumonia, tuberculosis, bronchitis, deafness, neuritis, rheumatism, and Bright's disease.

The far-reaching, but little regarded, effects of cold, as the primary cause of many human ills, can only be referred to very briefly here. This important subject will be discussed in a subsequent chapter. The following brief observations will serve to show how the common effects of chill are disregarded. If a baby chick is chilled, it develops diarrhea and dies; when a human baby has the same trouble and dies it is called "summer complaint" and is attributed to the microbes in the milk. After

a race horse has been exercising, it is covered with a blanket and leggings and made to walk slowly for half an hour. If it is allowed to stand it stiffens from too rapid cooling. A professional baseball player will put on a sweater after exercising. Many people, however, when warm from exercising, will sit in an open trolley or auto in a forced draught, and then attribute any resulting illness to infection, and auto-intoxication, or heredity.

Third Vital Factor—Sleep

Sleep is the third vital factor on which the health or recovery of nerve cells depends. With a great many persons, because they are simply tired, all symptoms will disappear if only some extra rest is taken, since by cutting down the expenditure of nervous energy *the nutrition of the nervous system is improved.* It is assumed in these conditions, that the food factor was maintained and that the circulatory apparatus was not so exhausted as to be unable to maintain a sufficient nutrition.

But if the blood vessels are greatly relaxed (low tension) or greatly contracted (high tension) from fatigue of the controlling vasomotor nerves, resting may do little good because one vital factor, the proper circulation, is deficient. Further, if the rest is too prolonged, as in the rest cure, the circulation may be so retarded, especially with low blood pressure, that the benefits which might have accrued from moderate rest are lost because another vital factor, the normal circulation, is deficient. Other factors being equal, a man with the most vigorous circulation can endure the most fatigue with the minimum rest, because his rate of nutrition is more rapid than in another man who requires a longer time to recuperate during sleep.

If the rate of the circulation is slowed, a man may eat well and sleep long and soundly and yet feel quite unrefreshed because his rate of nutrition was too slow. A man's strength depends on the vitality of the nerve cells in the spinal cord and brain. Every man's daily physiological income of strength is limited. If he lives beyond his income, the weakest nerve cells first become more irritable. The resulting symptoms may be

any so-called nervous trouble, or any variation of blood supply to any part of the body, complicated perhaps by the subsequent infection of the weakest tissue. The symptoms may result from any contraction or relaxation of any internal or external muscles; the symptoms depending on what cells first become weak, whether they are in the brain or cord, whether they are sensory, motor, vasomotor, visceromotor, or musculomotor nerve cells.

If the musculomotor nerve cells (nerves which control voluntary muscles) are excessively irritable one may have spasmodic contractions of facial muscles (called tics), or of the neck muscles (torticollis), or a general condition (chorea, St. Vitus's dance), writer's cramp, or any other "occupational neurosis," may develop if certain nerve cells are overworked. If the nerves to the muscles are excessively irritable, cold may cause a contraction of any skeletal muscle, producing a stiff neck or lumbago, the degree of contraction of the muscle depending on the existing irritability of the nerve cells, or the severity of the cold. If some spinal muscles gradually contract, any degree of spinal curvature may result, but such curvatures or "displacements" of the vertebræ are results, and not causes, of the nervous condition.

If the visceromotor nerves (those controlling the involuntary muscles) are excessively irritable, one may develop asthma (from contraction of the muscles of the bronchial tubes), or pylorospasm (spasm of the muscles controlling the exit of the stomach), or cramp of any intestinal muscle or spastic constipation. Excessive irritability of the visceromotor nerves is also the cause of dysmenorrhea.

If the vasomotor nerves are weak or irritable generally or locally, one may have high blood pressure, or any acute or chronic congestion or hyperemia of any organ or tissue from headache to kidney trouble. This includes any "itis" (pharyngitis, laryngitis, bronchitis, gastritis, colitis, or neuritis). If the cerebral cortex has a poor blood supply any nervous trouble from phobias to insanity may develop. These cerebral symptoms may develop suddenly even in a previously healthy man if

the blood supply to the brain is sufficiently disturbed, as when soldiers develop "shell shock." The same symptoms will develop most easily in those whose cerebral or vasomotor nerves are weakest. If the vasomotor or cerebral cells are very weak the most insignificant shock, either mental or physical, produces the most extreme symptoms.

In the absence of organic changes, or the presence of infections, all of the above-mentioned conditions and many others will disappear, if the nutrition of the weak nerve cells is brought to normal by maintaining the normal rate of the circulation in brain and spinal cord.

If the spinal cord is anemic, locally or generally, the proper mechanical, thermal, chemical, or electrical applications to the spinal muscles will overcome the anemia. If part or all of the cord is congested or hyperemic, the proper opposite treatment will reduce the congestion and restore the normal sensitive equilibrium of the circulation; provided one will observe carefully all the physiological laws in regard to degrees of nervous irritability, and all the facts in regard to the circulation of the blood and the movement of gas, which are explained in subsequent chapters.

Certain tests which are necessary to determine accurately whether a spinal segment is anemic or hyperemic are an indispensable guide in the proper application of treatment. Without such careful and frequent tests, at the beginning and throughout the period of treatment, any spinal application is absolutely empirical and its results accidental.

CHAPTER III

SOME FUNDAMENTAL FACTS OF PHYSIOLOGY, PATHOLOGY, AND THERAPEUTICS

PART 1

Pathology and Malnutrition Synonymous

In the discussion of pathology (disease), and of therapeutics (the treatment of disease), and of etiology (the cause of disease), the most important generalization, the most fundamental conception, is that of Lazarus-Barlow:

> The pathology of nutrition is logically coextensive with pathology, for every pathological condition is fundamentally a nutritive one. Since the tissues are composed of cells or their derivatives, nutrition of a tissue comes to mean nutrition of its component cells, or cell derivatives.—Lazarus-Barlow, p. 437.

In other words, disease, however produced, even when caused by germs, is essentially a disturbance of the nutrition of cells. This is the converse of the familiar statement that the vitality of anyone, the strength, the resistance to disease, the ability to recover from disease, all depend on the tone and vigor of the circulation. This is true of the body in general and of every tissue in particular. "A good heart and blood vessels are the principal features of longevity."

Malnutrition Precedes Infection

Most observers seem to agree with Lauder-Brunton that tuberculosis is usually preceded by a period of depressed circulation. The same writer says, and it is a matter of the greatest importance, and a fact little appreciated by most, that chill, which can only disturb the circulation, is the common cause of infection. "One of the influences which are most injurious to the body and favor most the invasion of microbes is chill."

In other words, germs may lie dormant in the tissues indefinitely, like mushroom spores in the woods, until suddenly, when the vitality of the tissues is reduced by a disturbance of the circulation and the "optimum condition" is furnished, as a sore throat or a similar congestion of the lungs, for example, then suddenly the germs multiply with incredible rapidity.

Effects of Anemia

The effects on brain cells of anemia produced by a gradual obliteration of a blood vessel are well recognized. There will be sensations of fullness, heaviness, weakness, formication, pain, or perhaps discomfort in hand, arm, or face. The leg may drag or fingers feel a little clumsy. The speech may be disturbed. Twitchings of facial or other muscles may develop. This condition will be described in any textbook on nervous diseases, but a persistent constriction or dilatation of blood vessels in the cord or brain, especially in connection with depression of the general circulation, will cause irritability and weakness of all nerve cells in that area, and the resulting symptoms will depend on the amount of disturbance in the circulation and the nature, location, and degree of irritability of the cells involved.

The persistence of normal irritability in a nerve within the intact body depends first upon normal nutritive processes and the blood supply of the nerve. In this relation it should be especially mentioned that insufficient nutrition is generally followed at first by an increase in the irritability. Only after advanced disturbance does the irritability diminish. The physician should constantly bear in mind that whenever he encounters evidences of increased irritability of nerves under the influence of defective or disturbed nutrition, as may be manifested in various ways, such as general nervousness and irritable weakness, etc., the condition is the beginning stage of a diminution of nerve energy. Under such circumstances the nutrition should be improved by restorative remedies. Only the ignorant, misled by the signs of increased irritability of the nervous system, would employ depressing measures.—Landois, p. 633.

The prostration following a febrile disease is in proportion to the resulting disturbance in the circulation. Hence prolonged weakness commonly follows grippe which especially affects the

circulatory apparatus. The low blood pressure in cachectic, and following febrile states, becomes in itself the cause of the prolonged weak condition, just as the extreme fall of pressure which produces a faint would be fatal if the patient were placed in a position where the blood could not return to the anemic brain. Hence the benefit of treatment to raise blood pressure and improve the nutrition of the weakened vasoconstrictor centers.

The health of all filtering cells depends on their blood supply.

Just as it is unreasonable to suppose that starved and poisoned tissue cells can discharge their function normally, so it is impossible to imagine that a membrane of starved and poisoned endothelial cells can discharge its functions normally, whether we regard it as a filter or a secreting organ.—Lazarus-Barlow, p. 313.

We cannot imagine a vascular condition which is without its effect upon the renal epithelium, and can hardly imagine an alteration of the renal epithelium which does not depend upon some changes in blood vessels.—Landois, p. 551.

Thus we see that in the kidneys also, vascular and pathological changes are synonymous.

It is a familiar fact to all who have studied "visceral neurology" that chemical or electrical stimulation of the vasoconstrictors to any gland, as, for example, the salivary or sweat glands, diminishes the secretion of the gland, and stimulation of the vasodilators to any gland increases the secretion of the gland. In other words, the normal function of every gland depends on the amount of blood going to it, for nothing but the blood can supply the necessary materials. Hence, a disturbance in function, however produced, involves a disturbance in circulation.

Without going into the discussion of the existence or number of secretory nerves, whose activity in any case would be affected by changes in the circulation of the spinal cord, the following statements are interesting:

It has been customary to ascribe to the sympathetic a certain "trophic" function. It seems more proper to ascribe this nutritional control to its vasomotor function by means of which it determines the blood supply to the various parts.—New International Encyclopedia.

In the kidney the secretion of urine rises and falls with a rise and fall of renal blood pressure. . . .

Bile, the pancreatic juice, the secretion of the sebaceous glands including the mammæ, are all, so far as is known at present, formed without the intervention of other nerves than those which control the vascular conditions of the glands in question.—Lazarus-Barlow, pp. 526, 527.

The function of the macrophages is not to attack healthy tissue; it is to remove those, the vitality of which is impaired; and so long as the brain cells are *abundantly supplied with blood,* they will probably be allowed to *remain uninjured* by the attacks of the macrophages. I think therefore that while senile decay may be actually produced by the macrophages, we are justified in believing that it really originates in an alteration of the blood vessels. . . .

By careful estimation of the blood pressure, and by keeping the tension at a proper level by diet, regimen, and medicine, I believe that the cardiac failure, or the cerebral apoplexy, which are common causes of death in advanced years, may be averted for years, and life not only greatly prolonged, but the senile decay or paralysis, which are so trying to the patients themselves and to their friends, may be prevented.—Lauder-Brunton, pp. 207, 208.

The disturbing, injurious, and fatal results of vascular variations in the brain are described more fully in the section on "Cerebral Circulation," and they add great emphasis to the subject under discussion, namely, that pathology and malnutrition are synonymous. The recognized cause of most enteroptoses is malnutrition; primarily, necessarily, of the controlling visceromotor and vasomotor nerve centers.

Obviously, many conditions require surgical interference, such as cases of injury, infections, mechanical obstruction, growths, and the like, but the results are necessarily contingent upon the restoration of the normal circulation, without which no tissue can recover from any pathological condition.

Viewed from the standpoint of the central nervous system, the great amount of surgery which consists in operating on contracted or relaxed muscles, and for ligaments, is largely unnecessary, since tissues would recover their normal tone if the controlling cells in the spinal cord were receiving their normal blood supply. According to some surgical writers, fewer and fewer ovaries are being removed, since it has been recognized

that multiple cystic ovaries may be the result of interference with the efferent circulation, due to the effect of gravitation when the vasomotor tone is poor.

Most tissues of the body go through very similar stages of degeneration. First, there is hyperemia, as of the thyroid gland or enlarged liver; subsequently a development of connective tissue produces atrophy and other degenerations of the tissues. It is the vascular changes, even when excited by infections, which are back of and responsible for every stage of degeneration.

Atrophy may be uncomplicated, though this is rarely the case. Far more commonly it is associated with degeneration or infiltration processes, of which fatty degeneration and calcification are the chief. This is natural when we remember that all these processes agree in the fact that they are disturbances of cell nutrition on the way to cell death.—Lazarus-Barlow, p. 473.

Thus, whatever may be the primary cause, the immediate cause of cellular changes is always disturbance of blood supply, and consequent malnutrition.

Calcium salts are never deposited in perfectly healthy tissues, but only in tissues the vitality of which has been lowered or extinguished. . . . Osteo-malacia has often been preceded by a period of nervous or mental depression.—Lazarus-Barlow, pp. 461, 482.

This would involve vasomotor depression also. This illustrates the fact that many conditions usually considered anatomical should be considered "nervous" since they are controlled by nerve cells in the central nervous system. Since the nutrition of bones, as well as of other tissues, is controlled by the spinal cord, the present restricted use of the word "nervous" is most misleading.

The breaking down of protoplasm into the colostrum of milk, the formation of fat in the uterine muscle after parturition, are true cases of fatty degeneration. In both these examples the cause is the same, viz., a deficient blood supply. . . . The whole series of changes in writer's cramp, from slight spasm to complete paralysis and atrophy, seem to depend upon an impaired nutrition of cells due to overstimulation.—Lazarus-Barlow, p. 446.

There is an increased output of fluid from the blood vessels in the

Haversian canals, and the pressure which this fluid exerts is the chief cause of the great pain associated with inflammation of the bone.

This illustrates how congestion causes pain also in neuritis or toothache, where the nerves are pressed upon by the dilated blood vessels inside the unyielding tooth or nerve sheath.

In view of all the foregoing facts, one can understand the need and value of restoring the normal circulation, even when antitoxic, antiseptic, or surgical treatment is also necessary.

PART 2

Quality vs. Rapidity of Flow of Blood

The writer does not wish to appear to ignore all the chemical changes and "auto-intoxications" of the tissues, to which so much elaborate study has been given in recent years, but we should remember also that mere slowing of the rate of flow of the blood through a tissue, as a result of chill, can produce any degree of chemical change both in the blood and the tissue, producing even gangrene or abscess of bone, as well as those relatively insignificant auto-intoxications of which so much is said at the present time. Since these toxins may be the result of the slowing of the circulation, it should not be assumed that they are all absorbed from the bowels, and since the slowing of the circulation may be the cause of the formation of toxins, it would seem that the only logical method of removing the cause of those intoxications would be the reestablishment of the normal circulation.

Removing abscessed teeth or tonsils has no doubt benefited many people, especially when the abscessed teeth were the result of faulty dentistry, but boils and other abscesses are generally regarded, in other parts of the body, as a result and not the cause of one's condition. The same logic should apply to some extent to the teeth and tonsils.

In speaking of rapidity of flow of blood it is assumed that it is equivalent to volume flow, if the artery is at normal tension.

As the circulation of lymph in any tissue slows down from any cause, the percentage of waste products in the lymph

stream increases and the rate of nutrition of the tissue is reduced, and this constitutes a relative "auto-intoxication" of the cells. Congestion of the mucous lining or contraction of certain ducts of the kidneys or liver throws waste products into the blood stream, producing jaundice, uremia, and similar toxic conditions, but it is misleading to apply the term "auto-intoxication" to every case of arterial hypotension. Hypotension always produces large amounts of flatulence. This is usually termed "intestinal indigestion," but this is not a sufficient reason for depriving patients of their most nourishing foods, or of their teeth, tonsils, or sections of bowels.

If a patient has obviously overworked and has acquired a condition of general low blood pressure, will starvation cure this exhaustion? Why not increase the patient's rate of income of strength by restoring the rate of the blood flow to normal, maintaining a liberal diet, and cutting down the nervous expenditure by some extra rest?

In pathological conditions where any attention is paid to the blood, it is the quality of the blood which is emphasized, almost to the exclusion of the rapidity of its flow. It should be remembered, however, that even if the quality of the blood is normal the most serious symptoms may develop in any part of the body if the rapidity of the blood flow is retarded.

If a man with normal blood faints, or has heat prostration, it is universally recognized that it is of primary importance to restore the normal rate of the circulation through the brain; it is not less important to restore the normal rapidity of blood flow if a man is on the verge of collapse from typhoid or any other infectious condition of the blood. And there are stages long before collapse begins when it would be of vital importance to maintain the normal rate of blood flow; and just as attempts to modify the quality of the blood in a faint would be considered misdirected, inadequate, or futile, even if it were the result of infection, so also in many earlier stages of conditions due to infection, attempts to modify the quality of the blood may be equally misdirected and futile.

The use of any antitoxin for dysentery would help to destroy

the bacilli, but cannot restore the vasomotor equilibrium; whereas spinal treatment, which powerfully affects any vasomotor mechanism, changes the condition of the bowel, on which the multiplication of germs depends; and when one has seen the immediate effect of spinal treatment on dysentery, it would seem that the antitoxin treatment would be quite secondary, if not entirely unnecessary.

Therapeutics, when restricted to serum injection, is obviously one-sided, and one who has not considered the possibilities or tried the effects of restoring the normal rate of blood flow by exact spinal treatment, can have no idea of the relative value of the two methods, which at least should be combined, if necessary.

Spinal treatment, which restores the normal rapid flow, makes so great and immediate improvement in many conditions which are commonly attributed to "uric acid" or "auto-intoxication," as well as in many febrile conditions resulting from specific infections, that one is forced to the inevitable conclusion that usually the rapidity of flow of the blood is relatively a far more important and fundamental consideration than the quality; except, of course, in conditions due to the most virulent organisms, as of tetanus and venereal diseases; also that the symptoms commonly attributed to the changes in the quality of the blood are largely due to the disturbance in the circulation caused by the infection. Just in proportion as the quality of the blood is impaired, the rapidity of the flow becomes increasingly important and especially to those tissues where the blood is manufactured or to the organs which alter its quality.

All conditions which modify the constitution of the blood or its distribution are liable to produce tissue change. In most cases the blood supply or the blood itself is altered in the direction of *deficiency*.—Lazarus-Barlow, p. 438.

If the blood supply is normal to all parts of the body, the glands or other tissues which manufacture the constituents of the blood will produce normal blood.

Since H. A. Kelly in his "Gynecology," 1909, indorses mechanotherapy as a cure for muscular rheumatism, even of twenty

years' standing, it shows that the vasomotor changes, which alone can be the primary effect of spinal treatment, are of so great importance that the uric acid factor may be negligible. The quotations under "Cerebral Circulation" show that variations in mental conditions are also the immediate result of variations in the rate of blood supply of the brain.

PART 3

The Body Controlled by the Spinal Cord and Brain; or Anatomy vs. Physiology

It is, of course, a familiar fact that the nutrition, growth, secretion, and functional activity of every tissue in the body are controlled by the central nervous system, but it is not quite so well understood that, as Landois says, "The normal irritability and therefore the normal functional activity of the spinal cord depend on the continuance of the normal circulation." The life of the human body depends, therefore, on a circulatory circle. Vasomotor nerve cells in the spinal cord and medulla maintain a definite degree of constriction of the blood vessels of the body. If the abdominal blood vessels relax, the brain and cord become anemic and the normal activity of the nerve cells is disturbed. A man may live, and for an indefinite time, with any degree of this hypotension of blood vessels short of fainting. The normal circulation may also be disturbed by varying degrees of hyperconstriction of the arteries, until the heart or some other organ gives out from increased resistance. Either condition is a measurable handicap and is starving out the nerve cells.

Although it has been so thoroughly demonstrated, most notably by Carrel, that organs and tissues can live and functionate for varying periods, even when severed from nervous control, still, as Lauder-Brunton has shown in regard to the heart, the maintenance of the normal physiological activity of any organ depends on nervous control. Even if the functions of various glands depend partly on substances brought to them by the blood stream "independently of nervous control," still, the

necessary rate of flow of the blood stream depends on the normal activity of the controlling vasomotor nerves.

At present, except in actual changes or destructions of the spinal cell bodies, usually from general infections, the view taken of pathological conditions in any part of the body is frequently quite local, peripheral, and unphysiological.

To prove this statement I need cite only the frequent protests of neurologists against most operations on neurasthenics. It is obvious that, if all the controlling cell bodies in the brain and spinal cord are weak and irritable, necessarily skeletal and visceral muscles will contract or lose all tone, organs will become displaced, or any kind of vasomotor disturbance will occur or persist.

We may go farther than this: Spinal treatment, which produces an anemia of the cord locally, can, at least in patients with hypotension, produce a neurasthenia of cell bodies in the spinal segment from which the nerve arises. This neurasthenia can be produced in a few minutes, if the cell bodies are already irritable, more slowly in others. The neurasthenia of nerve cells in any segment can be reduced at once, if it is due only to a temporary vasomotor disturbance, gradually, if the cell bodies are fatigued; therefore the operations which are futile, unnecessary, or injurious for those who are generally neurasthenic may be similarly undesirable for those with neurasthenia of any one spinal segment, no matter whether this local neurasthenia results from trauma or follows some illness which like typhoid may leave a weakness of certain segments, or follows fatigue, excitement, or cold.

The fact that the viewpoint of practitioners was largely anatomical rather than physiological is illustrated by the following quotation from Osler's "Principles and Practice of Medicine," 1906, p. 890, on neuroses of the stomach:

> The studies of Leube, Ewald, Oser, Rosenbach, and many others have shown that serious functional disturbances of the stomach may occur without any discoverable anatomical basis.

This shows how most men have expected, as many still ex-

pect, to find an anatomical lesion to account for every serious stomach trouble.

Many are so perversely optimistic as to hope to find an anatomical cause for every nervous disorder which is not "psychic"—in their definition of the word. One writer who had made many autopsies on those who had a blood pressure of 200 mm. or more, found a "lesion" in every case in the brain or kidney to account for the high pressure; as if anyone's brain, kidney, or heart would not inevitably develop a lesion, if subjected indefinitely to a blood pressure almost twice the normal! We know also that a rise in blood pressure is a common result of overwork; and cardiac failure or arteriosclerosis or injury to the kidney or other tissues must sooner or later follow.

The most extreme position is that of the surgeons who hold that hyperacidity of the stomach is proof of the existence of an ulcer, notwithstanding the failure of exploratory operations to find ulcers even with some of the most extreme cases of hyperacidity. Spinal treatment not only affords the opportunity to do something of immediate therapeutic value to the patient, since it can relieve acute functional disturbances at the time and ultimately cure the underlying chronic functional weakness, but it also helps one to determine what conditions are purely functional.

The immediate or gradual and permanent changes which can be produced in the contraction of cardiac, gastric, intestinal, and skeletal muscles by spinal treatment, as well as measurable vasomotor changes, ought to prove the central control of muscular, vascular, and nutritional changes in tissues. Even when the conditions have become complicated by infections, growths, or degenerations of tissue, the recovery of a tissue depends on the vitality of the controlling nerve cells.

The classification of diseases of the heart as functional or organic is in itself largely responsible for the ever-increasing number of deaths from heart failure in middle life. This is due to the fact that the heart, except when injured by a local infection, is merely the "victim of circumstances" when it does succumb and develop organic trouble. In all human beings,

except those with hypotension, all forms of fatigue, cold, infection, disease, and old age, increase the tension either of the arterial or alimentary tubes of the body. As this tension increases, the circulation is gradually or suddenly throttled, either by the contraction of the arteries or of some part of the alimentary tube, whereby the incarcerated flatus oppresses the heart. Either the heart gives out suddenly or gradually, or the slowing of the circulation allows congestions to develop in some vital organ, or a fatal cramp develops as a result of the increasing irritability of all nerve cells.

No mechanician would say that an auto had a nervous engine. Neither should anyone use the expression "a nervous heart." When people run down, either rapidly or slowly, the first part of the anatomy to give out should not always be considered the cause of the nervous condition; it is more often the result. Neither should nervous trouble be ignored until an organic trouble develops. The classification of a heart condition as organic or functional may be useful and exact at a given minute, but the terms are misleading as to their relative dangerousness. Similarly, to call every condition where the blood pressure is high "arteriosclerosis" is misleading. If the irritability of the vasomotor nerves can be reduced until the pressure is 120 with an excellent pulse, another name must be applied to the condition.

Some may wish to designate as "organic" the necessary nutritional difference which must exist between normal nerve cells and those which are overworked or starved, but otherwise the expectation of finding an anatomical basis for all nervous diseases is a very serious misconception, because hyperemia of a tissue may be primarily, and commonly is, a purely functional and vasomotor disturbance, and yet this hyperemia may persist until all kinds of hypertrophies or degenerations have developed with or without the aid of invading micro-organisms. We should not, therefore, overlook the purely functional origin of these conditions, even though the ensuing tissue changes have become a source of irritation or danger and demand surgery. We should bear in mind the necessity of reestablishing the vaso-

motor tone of the tissue, if we would prevent a return or extension of many troubles. Neuritis is a common condition which should be treated as a functional disease, even when tissue changes have begun; because since the proper amount of treatment for the proper spinal segments will relieve and cure sciatica and all uncomplicated neuralgias with precision, the attempt to cure such conditions by operations is obviously indirect; and the failure of these methods has proved to a great many sufferers that these forms of treatment have no relation to the cause.

If one has infantile paralysis, it is recognized by all that the trouble is due to destruction or weakness of nerve cells in the spinal cord and that the contraction or weakness of the muscles or a sore in the skin is entirely a superficial manifestation of trouble in the cord. However, if one has rheumatic muscles or disturbance of the stomach or kidneys, most men treat the muscle or the disturbed organ as if it were the origin of the trouble. This mental attitude is inconsistent and illogical, even if the trouble has persisted so long that local treatment or surgery is necessary. Prolonged or extreme anemia of the brain and cord may cause death or a gradual starvation of all nerve cells, so that a progressive paralysis of the whole body may develop. The dividing line between functional and organic diseases of the cord may be imperceptible.

If, in experimental work on animals, the nerves are cut which control the blood supply of an area of the skin where a sore has been produced, the skin loses its normal power to heal. Similarly, if the vasomotor nerves to any tissue have been exhausted or paralyzed by prolonged exposure to X-rays, radium, or other irritants, the healing of the resulting sore will be retarded or prevented according to the nervous control. The condition of the spinal cord, therefore, determines one's recovery from any disease. The condition of the cord should, therefore, never be disregarded, and one should never be satisfied with purely local treatment. Local treatment of the stomach, for example, no matter how chemically complicated or impressive to the patient, may be essentially superficial and inadequate.

When one has seen the accuracy with which acutely cramped involuntary muscles in the pharynx, pylorus, intestine, or any similar tissue, can be made to relax, it must inevitably appear that the attitude of most men toward such conditions is far too anatomical and local. A reflex may be excited either by a peripheral or a central stimulation. Attention is usually paid to peripheral irritations, or to central irritation excited by micro-organisms or mechanical injuries. However, anemia or hyperemia of the cord and brain may excite reflexes just as powerful as, and far more frequent than, any peripheral stimuli. Nothing but spinal treatment could enable one to determine from the outside how far an abdominal cramp is the result of central and how far of peripheral stimulation. The presence of an abscess might make an operation absolutely necessary, but contracted or relaxed muscles, or anemia or hyperemia of tissues, are conditions controlled by the spinal cord, and most surgical operations are merely the removal of the results of pathological processes.

Crookshank remarks: "We should hesitate to disregard 'functional symptoms' merely because our dull eyes can find no organic lesion, which, if we did, would probably be quite irrelevant, except as evidence that accident had occurred. It is not an exaggeration, though it may seem a paradox, to say that people do not die of organic disease so often as of disturbance of function; without alteration in cellular states." p. 44.

Since it is possible by simple spinal pressure to create almost any degree of "functional disturbance," and since death, except when tissues are injured or destroyed, is only a functional disturbance, it ought to be a subject of vital importance to humanity to know how to relieve functional disturbances. The anatomical viewpoint is the greatest obstacle to acquiring this knowledge. Take for a moment the most familiar symptom, flatulence, which is the immediate cause of death after so many operations, often also the cause of death in pneumonia, in most cases of "heart failure," "acute indigestion," and even with "arteriosclerosis." Flatulence may be the cause of the last fatal

rise in pressure. Indeed there is no disease where flatulence cannot be the cause of death.

It has been a subject of discussion whether or not gas is secreted by the stomach and intestines or is always the result of fermentation or from swallowing air (aërophagy). Crookshank's monograph on "Flatulence" ought to prove that flatulence is diffused from the blood. In any case, by dilating the blood vessels of the spinal muscles of patients with relaxation of the blood vessels (hypotension) especially of the stomach, any amount of gas may be created with incredible rapidity and, by reversing the treatment, as rapidly stopped.

The physiology of the formation of flatulence has been ignored because so many men have been satisfied to account for any case of extreme flatulence by calling it "neurotic." Crookshank however calls attention to the fact that, "some cases are in the old, others in the young, some in sober men, others in silly girls" and even in cattle after "chill and fatigue," and further he alludes to those patients who have died soon after they have been told that their symptoms were only "neurotic."

Most of those who give manual treatment also have an anatomical viewpoint of pathology and therefore of therapeutics. However, since the writer has never found it necessary to manipulate the vertebræ in any way, it is proved that many of the results so commonly attributed to "readjustment" or other manipulation of the vertebræ were in reality due to the vasomotor and other reflexes incidentally excited by the pressure applied to the spinal muscles. Some of the most remarkable results have been obtained by treatments consisting of spraying a few drops of alcohol upon the spine. Such conditions, which were due to low tension of the arteries, would be, and usually had been, aggravated by more forcible forms of treatment. A procedure which gives uniform results on the most sensitive patients can be applied to all cases with greater certainty than methods which can be endured only by the more robust. If a patient is subjected to a routine course of manipulation requiring from twenty minutes to an hour, it becomes impossible for

the most scientific intellect to distinguish what was essential and what accidental to the production of the results attained.

The fallacy of the "readjustment" explanation is further exposed by the effects of treatment of the sacral segment; here dislocation of vertebræ is impossible and yet the same laws apply to treating these spinal nerves as in treating the nerves between separate vertebræ. As Treves says, "The vertebræ may be fractured without being dislocated, but a dislocation without a fracture is *rarely* possible." The spinal muscles may contract with extreme force and tilt vertebræ from the normal position or cause a clicking of the sacroiliac joint, but the cause of the trouble may still be purely nervous and not anatomical. As soon as the contracted muscles relax by reducing the irritability of the controlling nerve cells the bones resume their normal relation.

It is superfluous to give many illustrations of the prevalence of, and the harm resulting from, the anatomical attitude toward pathology, because the results of spinal treatment make it self-evident to any investigator.

This very general tendency to ignore the physiology of the circulation and to treat all pathological conditions either from the anatomical or psychical standpoint creates in the mind of a practitioner an artificial and purely subjective limitation to spinal treatment; he becomes a mere spectator of most pathological processes until they reach a possible surgical stage, and leaves therapeutics in the hands of men, otherwise less qualified, but who have not failed to see the possibilities of even the most empirical forms of spinal treatment.

Vascular variations in the spinal cord will be discussed more in detail in a subsequent chapter, but it is only by regarding symptoms primarily from the condition of the spinal centers that we can understand that exact generalization of Lazarus-Barlow, "Every pathological condition is fundamentally a nutritive one." Failure to recognize the far-reaching effects of even the slightest variations in blood supply to the spinal cord will explain the ignorance and skepticism in regard to the possibilities of spinal treatment. It is, therefore, of the greatest

importance that both physiology and pathology, and therefore therapeutics, be regarded primarily from the fundamental viewpoint of the relationship of the individual cell to its blood supply, and especially, of course, the nerve cells of the spinal cord and brain.

PART 4

Segmental Structure of Body

It is also of vital importance to bear in mind the segmental structure of the nervous system. This segmental plan is obvious in all animal organisms from the worm to man. (See Loeb's "Physiology of the Brain.")

The segmental structure of the vascular system is also obvious:

> In conformity with the general plan of the vertebrate body, the vascular system is essentially segmental in character. This is obvious even in the adult, in the intercostal and lumbar vessels. It is distinguishable, though less obvious, in the vessels of the head and neck and of the pelvis.—Cunningham, p. 938.

Every treatment given is a demonstration of the segmental structure of both the nervous and vascular systems, since treatment of only one segment can stop a circumscribed throbbing in any part of the body as in the eye, the thumb, or the toe, or relax a cramp in any voluntary or involuntary muscle. It sometimes happens that a patient has a high blood pressure with a variety of mental, motor, or sensory disturbances, all the result of irritability of two or three dorsal or lumbar or sacral segments; if proper pressure over these segments relieves sometimes at once the high blood pressure and all the other symptoms, it is obvious that no general treatment, or the use of any drug or combination of drugs for such a condition, could ever meet exactly the pathological requirements or have the slightest relation to the *cause* of the trouble. If it can be demonstrated that certain cases of intermittent but persistent nosebleed were due to irritability of certain abdominal segments which caused a rise in blood pressure, forcing the blood through the highly vascular mucous membrane of the nose, how second-

ary, superficial, and misdirected either local treatment of the nose or general medication appears. This contrast between general and segmental therapeutics becomes increasingly painful to anyone giving segmental treatment.

Unless one takes into consideration the spinal segments involved in each case, a diagnosis also may have a very limited value.

Many illustrations of this fact might be given; *e.g.*, cases where most competent practitioners had treated a weak heart with cardiac stimulants or nitroglycerine to lower blood pressure. In these cases the obviously affected and more sensitive segments were those controlling the stomach, and as each spinal treatment liberated the gas from the stomach, the pulse became strong and the blood pressure normal. This proved absolutely that the cause of the weak heart action was incarcerated gas.

"Treating the cause" is supposed to be a fundamental therapeutic law, and yet in many conditions no one can be sure that he is treating the cause, if attention is not paid to the segmental structure of the body.

No man with scientific instincts would prefer to use a less rather than a more effective form of treatment, except perhaps as a matter of convenience; *e.g.*, antipyretics are more convenient than bathing the patient but less effective. If a patient has an obviously throbbing headache, with rapid pulse and high blood pressure, and treatment of certain spinal segments will slow the pulse, lower the blood pressure, relieve the headache, and reestablish the normal circulation, who would prefer to use a heart depressant except to save physical effort? The headache may be the result of trouble in the sacral segments, in which case the headache medicine would have no relation to the cause. When one has brought a rapid, slow, or intermittent pulse with high or low blood pressure to normal several hundred times in a year, by proper treatment of certain segments, it becomes evident that the heart action is disturbed chiefly by abdominal conditions, and therefore the use of heart stimulants and depressants has no possible relation to the cause; and since these results can be produced sometimes *only* by the briefest

possible pressure over *certain* segments or half segments, and perhaps by several minutes' pressure over *other* segments, it proves that no form of medication can ever be exact and affect only necessary segments, and it proves also that no one can rely on the mental effect of treatment to produce any exact or scientific results.

Obviously, general therapeutic methods may produce beneficial results, because whatever strengthens the body in general, will, as a rule, strengthen the weakest cells proportionately, but only proportionately; but, if certain segments only are involved, general medication, general massage, general electrical or hydropathic treatments are obviously indirect, and even when beneficial can never compare with the accurate results obtained by segmental treatment.

PART 5

Effects of Increased Irritability of Nerve Cells

As was explained in Chapter I, the severity of all symptoms depends on the degree of irritability of the controlling nerve cells in the spinal cord and brain.

If some or all of the vasomotor centers become abnormally irritable, there will follow corresponding vascular disturbances. If the vasomotor irritability is general, there may be continued or occasionally excessive variations in the blood pressure or heart action or in both; if the vasomotor centers in only one spinal segment or half segment are excessively irritable, there will be vasomotor or nutritional disturbances in the area controlled by that segment, or if the segment controls abdominal blood vessels there may be variations in general blood pressure from overirritability of the vasomotor centers in this one segment.

If the vasomotor disturbance is general, sooner or later the nutrition of the brain and spinal cord will suffer and there will be an increase or decrease in the irritability of the whole central nervous system according as the general vasomotor disturbance is diminishing or increasing.

If the visceromotor centers become overirritable, gas is held

in the stomach or bowels wherever the nerves are most irritable and, in uniform proportion to the severity of the contraction of the gastric or intestinal muscles, the heart action or blood pressure or both are disturbed. Irritability of the visceromotor centers may therefore cause any degree of chronic, acute, or fatal indigestion, or it may aggravate any symptom which any patient is capable of having, and is the cause of a great variety of operations on the stomach and bowels.

If the musculomotor centers become overirritable, there appear those more obvious contractions, clonic or tonic, of skeletal muscles. This is the cause of rheumatism in muscles even when the condition is complicated, as is usually the case, with local vasomotor disturbances or the presence of uric acid deposits.

If the cells of the brain become overirritable, there will develop according to the location of the most irritable centers, all forms of so-called "psychic," "mental," or "emotional" disturbances, but such excessive irritabilities and mental incoordinations, whether under mental control or not, even actual insanities, may be as purely physiological as writer's cramp or tennis leg.

As nerve centers become increasingly irritable they respond more and more excessively to the particular stimuli to which they are made to respond, whether mental stimuli to affect the brain cells, or mechanical, thermal, and electrical stimuli for nerve endings in the skin, muscles, or other tissues, or sound or light waves for the auditory or optic nerves. Within limits, the brain can inhibit excessive responses of overirritable nerve centers, but a point may be reached where the mental or muscular response is quite beyond the control of the will. To expect control from one whose centers have reached this degree of automatic irritability is unphysiological and cruel.

The effect on nervous irritability may be the same whether the blood pressure rises above or falls below normal, or is apparently normal with a weak pulse; if the rate of flow is diminished, the irritability increases.

Variations in blood supply to the spinal cord or brain produce

immediate variations in the irritability of the nerve centers, no matter whether these variations in blood supply are caused by fatigue, cold or heat, indigestion, mental emotions, infections, traumatisms, or mechanical, electrical, or thermal applications to the body.

Fatigue. Nervous irritability may be a measure of nervous fatigue; if one overworks for years, all nerves, especially the weakest, become more and more irritable. If the vasomotor nerves are affected, fatigue produces, in a majority of cases, an increasing rise in blood pressure. Sooner or later this rise in blood pressure will cause some disturbance or ultimate injury to the arteries, heart, kidneys, or central nervous system. How could the heart or kidneys or arteries be subjected to a blood pressure 50 per cent or 100 per cent above normal and continue to functionate normally? How could the central nervous system keep its normal strength with so great a resistance to the heart action?

Klatz, experimentally, has proved that hypertension alone may cause arteriosclerosis. After suspending rabbits with the head down for a definite length of time each day, he found at autopsy well defined sclerosis of the aorta.—"Blood Pressure," W. H. Cowing, p. 80.

Hence it is quite illogical to attribute the hypertension always to the inevitable resulting lesions in the arteries, brain, or kidneys, or to eating meat.

Physiologists have demonstrated that in normal people fatigue reduces nervous irritability, that is, nerve cells (auditory, optic, and others) respond less quickly to stimulation, but long continued starvation may produce any degree of pathological irritability, as of the cerebral motor cells in epilepsy or of the intellectual areas as in insanity.

If the nerves of the stomach reach a certain stage of fatigue or irritability, the cardiac and pyloric orifices contract from the slightest stimulation of acidity, flatulence, cold, or excitement, or irritation of any part of the nervous system. Many people have so fatigued the heart or whole vascular apparatus that the slowing of the circulation, which necessarily occurs during a period of relaxation, so increases the irritability of the whole

nervous system as to cause, temporarily at least, digestive disturbances or great mental depression or suffering, whenever they try to rest. Ordinarily, rest reduces irritability, unless it is so prolonged as to slow the circulation and diminish the rate of nutrition of the nervous system. Exercise, by accelerating the circulation, reduces nervous irritability, unless carried to the point of excessively fatiguing the nerves, especially those controlling the circulatory apparatus, in which case it increases the irritability because it has actually left the circulation slower than before.

A bright light, stimulating the retina, if the optic nerve is sensitive, may be sufficient to affect the vasomotor nerves and cause a headache or aggravate any symptoms.

Since the nerves to the spinal muscles supplied from any irritable segment become irritable as well as the nerves to the simultaneously affected organ, all treatment must be regulated according to the irritability of the nerves of each patient.

Cold air by contracting the external blood vessels slows the circulation, if the heart action is weak; cold air, therefore, for these patients increases nervous irritability; if the heart action is strong, cold air accelerates the circulation by the contraction of the blood vessels and reduces irritability. Cold is the ever-present and usually unrecognized cause which produces vascular variations in the general or local blood supply of the brain and spinal cord, affecting therefore at once any irritable nerve centers, repeatedly and constantly aggravating therefore any acute or chronic pathological or even so-called "nervous troubles." The patient is more certain to aggravate pathological conditions by exposure to cold, if the condition is, as is usual, attributed to some variations in the quality of the blood —auto-intoxication, uric acid, and so forth—instead, as can be quickly proved by mechanical means, of being attributed to variations in the rapidity of flow of blood. Even abscesses of the gums, or in the leg bones, according to Da Costa, may be caused by cold; ulcers also of the mucous membrane may be so caused. Too hot weather, by dilating the blood vessels of the

head in particular, or of the body in general, retards the rate of blood flow and increases nervous irritability.

Infections produce symptoms as the result of increased irritability of the central nervous system, because their presence produces variations in the blood supply of the spinal cord and brain. The infection by its presence irritates the vasomotor nerves in the tissue invaded and causes some degree of hyperemia or congestion, but since spinal treatment which can affect only the rate of flow makes some immediate reduction of the symptoms in most infectious fevers, it is proved that the symptoms are the immediate result of the vasomotor changes. Indeed most infections require some preceding vasomotor disturbance in the tissues, usually from cold, in order that the micro-organism may have a favorable soil for its multiplication.

Nervous irritability is one definite limit to life. If the vasomotor nerves in any spinal segment become sufficiently irritable, they will raise the resistance to the heart action to a point fatal to the heart, brain, or kidneys, or the retarded circulation will so increase the irritability of some visceromotor nerves as to cause contraction of involuntary muscles, which will be fatal to the organism; it may be the pylorus or any part of the intestinal tract, sometimes the appendix.

Just in proportion as this excessive nervous irritability of the vasomotor or visceromotor nerve cells can be reduced, life is prolonged. (See quotation from Lauder-Brunton under Pathology and Malnutrition.) Irritability of nerve cells in the sacral segments may cause painful, dangerous, or fatal contractions of any intestinal, arterial, or uterine muscles.

The most insignificant pressure on these sacral spinal muscles, if the nerves are irritable, and especially if it causes the slightest pain, may cause the most violent contraction of the intestinal or uterine muscles or of the pelvic arteries. On the other hand, proper treatment of these sacral segments will diminish or relieve entirely the most intense pain from muscle spasm and also control the blood supply if there is no local active irritation, and will often diminish the cramps even with a local irritation.

In recent years there has been a great increase in so-called circulatory diseases. These are the cause of death in middle life of many of the most successful business men. It is the result of overwork and fatigue of the vasomotor nerves. This increased irritability of the vasomotor nerves may be unsuspected but it explains the unexpected collapse or death, from heart failure, of men in the prime of life during some serious illness.

Since the blood pressure reaches or approaches 120 mm. during treatment of all adults, it is ignoring one of the most reliable warnings the nervous system offers, if it is assumed that it is normal for the blood pressure to rise with increasing years. It is customary but not ideal or normal and represents a measurable handicap for anyone.

Since it can be readily demonstrated on those with a certain blood pressure that interrupted and continuous pressure on spinal nerves produce opposite and uniform variations in irritability and functional activity of all nerve centers in the spinal segment from which the nerve arises, it is obvious that such pressure must produce variations in the blood supply of the segment treated. It follows also that the injurious effects of blows on the back and the effects of some methods of alleged therapeutics are the result of vascular disturbance produced in those segments and though in some cases the results follow gradually, they are inevitable. The same results may follow any acute illness, as a lame back or leg following typhoid, because the typhoid fever left a vascular disturbance which was most marked in certain segments and the gradual starvation of the cells in those segments produced an increasing irritability.

It must not be imagined, however, that these laws of nervous irritability apply only to so-called "nervous" troubles, because the rapidity of recovery of any tissue, as well as the growth of any neoplasm, depends in large measure on the vasomotor tone of the area; the growth of a tumor depends on the amount of material brought by the blood.

A nerve cycle includes, of course, the cells in the cerebrum which are connected with the spinal cells. The irritability of

the spinal nerve cells seems always to be increased in proportion to the irritability of the brain cells, and brain workers or others with irritable brain cells always recover more slowly than manual laborers.

If the vasoconstrictors to the stomach are weak, too much blood goes constantly to the glands secreting gastric juice, and hyperacidity of the stomach results. When cold strikes the surface of the body, especially the back, the dilatation of the spinal vessels is increased according to the degree of cold. This throws into activity the musculomotor, visceromotor, and vasomotor centers and especially the most sensitive and irritable. In this way any chronic congestion of any mucous membrane (catarrh of the nose, stomach, or bowels) or flatulence or contraction of any muscles, is at once aggravated by cold. If the cold is intense it may produce any degree of hyperemia, even causing paralysis; a blow may do the same.

From the standpoint of the central nervous system there is no essential difference between the contraction of a neck muscle (torticollis), lumbago, pleurodynia, or any other rheumatic muscles; or spasm of the larynx, esophagus, bronchioles (asthma), pylorus (nausea), bile duct (biliary colic), sphincter of bladder (retention of urine), many cases of appendicitis, or dysmenorrhea from contraction of the muscles involved. The acute attacks can be relieved, usually, at once, or in a few treatments, each one of which gives some immediate relief. Any cause of irritation or fatigue of all or of any part of the nervous system increases the weakness and irritability of any other part of the nervous system (both vasomotor and musculomotor), especially of the weakest point. This explains why eye strain may aggravate any other trouble without being the actual cause of the trouble. Any flatulence affects the circulation so greatly that it may aggravate or cause trouble in any part of the body; and pain from any congestion or muscular contraction, especially in the pelvis or abdomen, may cause a rise or fall in blood pressure which may cause headache or other symptoms.

The effect of a counterirritant depends as much on the

irritability of the vasomotor nerves controlling the blood supply to the skin as on the intensity of the stimulant applied. If the skin is very sensitive, the mildest rubifacient may produce marked hyperemia; whereas if there is a marked hypertension of the cutaneous vessels any counterirritant will produce the minimum effect. The effect of all internal medication also depends on the degree of irritability of the nerves involved, but this degree of irritability should be determined, approximately at least, before any kind of treatment is given; and this can be determined only by testing the response of the vaso, viscero, musculo, and to a certain extent, the cerebral cells to certain uniform tests.

PART 6

Vascular Instability

A man who faints easily has usually so great a weakness of the vasomotor nerves controlling the abdominal vessels that the slightest shock, mental or physical, or fatigue, gravitation, indigestion, or cold, may cause these exhausted nerve cells to weaken, the abdominal vessels to relax and the brain to become anemic (one may faint from a weak heart action, resulting from high abdominal resistance, but that is not the question under discussion). Similarly, although the drop in general blood pressure may be slight or none, if any large abdominal vessels are constantly on the verge of relaxing, it may require the most insignificant cause to make them dilate and although the brain does not become actually anemic as in a faint, the relaxation of the large blood vessels so retards the rate of flow of the blood through the spinal cord and brain that any other weak local vasomotor mechanisms may suddenly give out and produce the most serious and even fatal local symptoms. Any local hyperemia, œdema, or the production of gas, may be suddenly and enormously increased, the amount of disturbance depending on the degree of slowing of the general circulation and the sensitiveness or weakness of the local vasomotor mechanisms. Even hemorrhage of the retina or of the brain may occur in this way. No matter what may have produced

the extreme weakness of the vasomotor mechanisms, if it exists, the most serious symptoms may follow the most insignificant causes. The descent from even a slight altitude to the seashore may cause a complete collapse of a patient with hypotension. The writer experimented on himself for several years in this condition. Men like A. T. Schofield of London, and Von Noorden of Vienna caution those who are extremely weak and even those having chronic colitis against going to the seashore or to a high altitude; and while the limits of this book prevent the presentation of the observations the writer has made, he can only protest earnestly against much of the advice and treatment given to patients with extreme vascular instability. The use of the words "hysteria" and "neurotic," etc., as applied to vasomotor weaknesses has entirely diverted the attention of many from the study of the physiological basis of nervous troubles, which enters also to some extent into every pathological condition.

The degree of sensitiveness of the nerve cells in the mental areas of the cortex is as much a matter of physiology or pathology as the irritability of cells in the spinal cord. People who usually have no marked sensitiveness of the sensory nerves in the skin, may suddenly develop the most exquisite painfulness of these sensory nerves, and from a purely physical cause as in neuralgia and cold. Similarly, a disturbance in blood supply to cells in the cortex may produce the most exquisite irritability of these cells in the cortex. If this sensitiveness in nerve cells exists in the skin, the most insignificant stimulation, as from pressure, may cause the most intense pain, and if such sensitiveness of nerve cells exists in connection with great weakness of the nerves controlling the abdominal vessels, the slightest jar or blow may make the most profound changes in the abdominal vessels and therefore in the general circulation. Similarly, if the cerebral cells are hypersensitive, the most insignificant psychic stimulation (and this is the only form of stimulation to which these cells are made to respond) may produce the most powerful vasomotor disturbance in the abdomen and therefore in the body in general or in any local area in particu-

lar. The slightest disappointment may, therefore, be as great an irritant to weak vasomotor mechanisms as the slightest pressure on a hypersensitive nerve. Obviously those people with the greatest mental control will have the smallest physical disturbance from mental shocks, but if the cerebral cells are too irritable no one can control them.

In the study of the nervous system and in its treatment, the degree of irritability of the nerve cells should first be considered. There will be then some basis for determining how much stimulation must be applied to produce desired results. If all obvious and all unrecognized conditions due to extreme nervous irritability are called "psychic" or "mental" or "hysterical," no clear thinking is possible and all therapeutics become empirical, because even when a man has typhoid fever from an obvious infection, it is just as important to know what will cause or relieve irritability of nerve cells, mental or vasomotor, as in any purely "nervous" disease. Delirium or hemorrhage may be just as much "nervous" trouble as melancholia or blushing, and no one can possibly understand the causes of gross vascular changes if he pays no attention to or does not understand the most insignificant fluctuations in the circulation.

All that has been said in regard to aggravating local swellings or hyperemias by a dilatation of abdominal vessels is also true if the circulation is sufficiently slowed down by overcontraction of abdominal vessels, with incompetency of the heart to meet the extra work demanded; but usually with high blood pressure there is, within limits, a better tone of local vasomotor mechanisms and therefore less vascular instability, and local or general fluctuations are not excited by such insignificant causes as when there is extreme hypotension, unless, of course, some of the vasomotor nerves are extremely weak.

Given a condition of great vascular instability, even with a normal blood pressure, it is easy to understand the extreme results produced by the most absurdly small shocks, mental or physical. Sensitiveness to mental impressions or ticklishness, or other hypersensitiveness of the nerves of the skin, are exact physiological guides to the kind or amount of treatment re-

quired, just as contraction of muscles is an indication of the degree of irritability of musculomotor nerves.

From a local disturbance in blood supply in any spinal segment, following any severe illness or mechanical injury, the nerve cells in that segment, even in a young person, may become more irritable than in an old man in good health. If these cells control the contraction of the arteries or the intestines, one's condition will be serious just in proportion to the irritability of the controlling nerve cells. Such contractions would, of course, be more serious in the old because the heart muscles are weaker, and necessarily cells lose excessive irritability more rapidly in the young. In actual treatment some conditions can be benefited only by the application of a few drops of alcohol to the spine and others will be benefited by the hardest possible manual pressure. This illustrates the wide range of possible degrees of nervous irritability and this difference in nervous irritability may exist between two adjacent spinal segments or half segments in the same patient.

In one patient the musculomotor nerve cells may be the weakest, in another the visceromotor, in another the vasomotor, or there may be any combination of these. It is therefore not scientific to classify symptoms as due to a "neurotic taint" whenever only the vasomotor nerves are locally or generally the weakest. If the vasomotor nerves to any gland are weak, there may be any "secretory neurosis," as an excessive secretion of gas or mucus from the wall of the stomach or intestine, but it should not be considered less manly or creditable to a patient to have a vasomotor disturbance, causing gas or mucus or even some mental symptoms, than to have a visceromotor disturbance, causing gastric or intestinal cramp. Such a classification is more "hysterical" than scientific.

The blood pressure falls in some people and rises in others as a result of the same factors.

This is only a part of the general question of degrees of nervous irritability. As soon as a certain stage of nutrition has been reached during treatment, the vasomotor, visceromotor, and musculomotor nerves all produce a hypertonicity of the

controlled muscles even though previously there had been a period of years of hypotonicity of the blood vessels, stomach, intestines, and skeletal muscles. No one set of these three sets of nerve cells is ever exclusively or uniformly affected, but tonicity of muscles whether of the arteries, intestines or skeleton seems to indicate a better stage of nutrition than atony. With general hypotension neither the heart muscle nor the cardiac nerve cells can receive as rapid a flow of blood as when there is a normal tonicity or hypertonicity of the abdominal vessels.

It is therefore a fundamental fact that the vasomotor nerve cells acquire and lose excessive irritability according to the same laws as all other nerve cells, but with certain characteristic differences. The ergograph and all human experiences have demonstrated that proper amounts of exercise, rest, sleep, and food increase the strength and reduce excessive irritability of the musculomotor nerve cells. Per contra fatigue, lack of sleep, lack of nutrition, or what is equivalent, a reduced rate of income from a depressed circulation, all weaken the musculomotor nerve cells and increase the irritability.

These facts are just as true of the vasomotor and visceromotor nerve cells but normally these nerve cells are less easily disturbed and recover more rapidly than the musculomotor cells. For example, a congestion of the cord, as in infantile paralysis, does more injury to the musculomotor than to the vasomotor or visceromotor nerve cells. Since the life of the organism, and of all the nerve cells, depends on the continuous activity of these automatic nerve cells, it is a necessary provision that their vitality and ability to recover is greater than of the other cells. If it were recognized that all nerve cells both in the brain and spinal cord are weakened or strengthened by the same certain, fixed laws, it would introduce a greater degree of order into the world of pathology and therapeutics.

The most notable fact of physiology which has been demonstrated by the writer's work is that the blood pressure in all adults, both men and women, should be exactly 120 or 121 mm. Hg. This is not an assumption or an expected fact but simply

the unvarying blood pressure after each segment has been properly treated, when the patient has reached the best physical condition and the irritability of all nerve cells is normal. In extreme conditions this cannot be demonstrated by each treatment and with incurable conditions never, but every treatment properly given brings the blood pressure toward this normal. The certainty of this result is a fact of great importance and significance.

Just as people may live indefinitely with a degree or two of fever or with a subnormal temperature, so people can live with the observed variations in blood pressure; but they are living with a handicap which shortens life and exposes them to attacks of any illness, because their vitality is lowered. An athlete may be in the pink of condition for some years and have a blood pressure considerably above normal, but a heart which is working against unnecessary resistance will give out sooner than if resistance were 20 or 30 mm. less. Since anyone feels weak if the blood pressure falls 40 mm. below 120 mm., even a drop of 10 mm. means a great handicap to the central nervous system. If, therefore, treatment can be so given as to bring the blood pressure to normal, it at once increases the strength and vitality, within measurable limits.

In addition to these changes in the circulation to the spinal cord and brain as a result of these variations in the general circulation, any degree of disturbance in the body may be produced by local constriction or dilatation of the blood vessels in any part of the cord or brain.

Contrary to his training and expectations the writer learned that the pulse and blood pressure test is an absolutely indispensable test in determining the kind and amount of spinal treatment.

A variation of only 5 mm. Hg. from normal, in connection with the pulse and abdominal conditions, often decides whether a patient shall be given five seconds or thirty minutes, more or less, of treatment, perhaps over only a single spinal half segment. This can be determined absolutely only after one has tested the response of a patient's splanchnic vasomotor mecha-

nism to the opposite kinds of spinal pressure and until any gas incarcerated in the stomach or bowels has been liberated and reabsorbed. The present accepted averages are of small value in doing exact work, because a man with an apparently normal blood pressure may have a drop of 40 mm. from the most insignificant spinal treatment. The amount of drop is an exact measure of his vascular instability.

PART 7

Pain

Another most important and far-reaching physiological law is that pain raises and lowers blood pressure and may therefore counteract the effect of all local applications; even the pain from a too hot footbath may add to cerebral hyperemia and increase the headache.

Since the author was most extremely sensitive, and since his sufferings were increased for a number of years by misapplied spinal treatments, he feels justified in giving some warnings against violent manipulations, as well as against spinal freezing, cautery, acupuncture (inserting hatpins into the back), and other violent proceedings recommended in standard medical works.

It is well known that in many people, even those in vigorous health, there is an exquisite sensitiveness of the skin over one or more spinous processes. This is the meeting point of cutaneous nerve endings from each side. It is evident that using a rubber hammer on these extremely sensitive spots may produce only those general effects on blood pressure which would follow any form of physical torture. Treves mentions the case of a man with a burn over the belly. While the burn was protected by the dressings the abdominal muscles would relax and the abdominal wall would move with the respiratory act. The moment the dressings were removed, the surface becoming painful, its spinal center became excited and the muscles at once contracted and the belly became rigid.

This illustrates one beneficial effect of all soothing liniments and plasters applied to strained or bruised muscles. They

reduce the irritability of the vasodilator as well as the irritated musculomotor nerve centers. This would illustrate the vital importance of making applications to the spine as unirritative as possible. It would show also that causing pain may destroy the value of physiological experiments and of therapeutic applications as well. The amount of nerve irritation required to cause pain, or any other effect, depends as much on the irritability of the nerves as on the intensity of the stimulus.

Too hard treatment may aggravate immediately any acute or chronic trouble if the patient is very sensitive and has very irritable vasomotor mechanisms. Even a light treatment may so lower blood pressure as to leave the patient for days, or even weeks, in a weakened condition, which is analogous to shock. It might be called spinal syncope, since the treatment so deprives the spinal vasomotor centers of blood that it is impossible for them to restore and maintain normal arterial tone. The wrong kind, or too heavy, treatment will immediately aggravate any acute condition, *e.g.*, diarrhea, neuritis, congestive headache, mental depression or distress, or any other acute condition previously mentioned.

It is a dangerous fallacy to say the effects of heat and cold are identical. While this is true of certain temperatures, under certain conditions, it is also true that cold applied to a frosted tissue will be beneficial, whereas heat would be injurious. Also if a patient has a low blood pressure from hypotension, with resulting cramps or other symptoms, a warm bag on the abdomen or back over the splanchnic area would be quite prostrating or dangerous, whereas a little cold properly applied to the spine would contract the abdominal vessels and be immediately strengthening. Also, for many people cold would cause pain and would therefore produce any of the bad effects of pain. Cold may also, even if it produces some decided local constriction, be exceedingly depressing to the whole organism. A few drops of water on the skin of some patients, even on the face, causes an immediate and powerful contraction of all the cutaneous blood vessels with immediate aggravation of all the symptoms. At a critical stage the use of cold might be fatal.

Spinal treatment should combine the quieting effect of soothing applications with the proper effect on the circulation. In cases where the nerves have become exquisitely irritable in addition to the vascular disturbance, the quieting effect should be especially considered, otherwise serious contraction of the visceral muscles or vasomotor disturbances will be produced. If the nerves have not acquired this exquisite sensitiveness, more strenuous treatment may affect the circulation favorably, but a stimulus must be proportionate to the irritability of the nerves. The more sensitive the nerves the lighter must be the stimulus.

Bowditch discovered that, "Minimal stimulation of the heart produced maximal pulsations"; similarly incredibly light stimulation of the vasoconstrictor nerves produces the maximal contraction of the arteries in cases of hypotension. This law explains the immediate and extraordinary results which can be produced in certain conditions by the lightest spinal treatment. This law is almost entirely ignored in almost all kinds of treatment. The mere tickling of the nose with a feather may excite a reflex (sneezing) the violence of which is out of all proportion to the force of the stimulus.

Although pain is undesirable when treating circulatory disturbances, it does not follow that what is immediately most agreeable to the patient is most beneficial. It is a familiar law that depressive drugs which quiet irritable nerves and temporarily relieve pain ultimately must increase nervous irritability. Similarly tea, coffee, tobacco, and alcoholic drinks may favorably affect the feelings and even the symptoms temporarily, but ultimately there is a reaction from such stimulation.

It is just as true that hydropathic and mechanical proceedings which are immediately agreeable and beneficial may be ultimately injurious, *e.g.*, cold bathing, which acts as a powerful vasoconstrictor, and for those with a strong heart action is therefore a powerful stimulant to the circulation, may make one feel better and give one more resistance to cold, but for those with high blood pressure it may be quite dangerous. Also for those with extremely relaxed abdominal vessels (hypo-

tension) cold bathing may increase the abdominal dilatation and aggravate any nervous trouble, as also does every exposure to cold air.

So also, a hot bath for those with low blood pressure may accelerate the circulation temporarily, produce sleep, and be most agreeable and yet steadily increase the abdominal hypotension, which was the actual cause of all the nervous symptoms. This is also true of sleeping with a hot water bottle; it produces a partial or general hypotension and great sensitiveness to cold, which is most undesirable even though the hot water bottle is sometimes a most necessary and beneficial temporary expedient. If the blood pressure is high or low from nervous fatigue, exercise which strengthens the heart action temporarily may be most agreeable and, within limits, most beneficial; but as it is often taken, it may be most injurious, because the blood pressure will be still higher or lower and the circulation really impaired rather than improved. Many invalids have become quite dependent on living in "fresh air," or even in a constant draft because it relieves certain unpleasant sensations in the head, the result of heat prostration, fatigue, or something which has impaired the vascular tone of the head. While the fresh air in itself is most beneficial, considered from every standpoint, the exposure to frequent drafts may constantly aggravate the disturbance in the abdominal circulation, which is the real cause of the disturbance in the cerebral vessels; and sometimes chronic invalids are simply victims of an ill-considered attempt to get "fresh air." Some people with serious stomach trouble, which offered great resistance to the heart action, have been kept at work for several years by massage, hot baths, and drugs, which dilated the blood vessels of the abdomen, muscles, and skin and so relieved the heart of considerable work. Ultimately, however, since nothing was done to remove the real cause of the extra work on the heart, the great loss of vascular tone produced by these combined methods steadily starved out the whole nervous system, leaving the patient in an exhausted and artificially weakened condition.

A fall in blood pressure may bring on the most extreme and

persistent constipation because of the anemia of the cord and consequent weakness of the visceromotor nerve cells. Cathartics which dilate abdominal vessels increase the existing hypotension, and, though immediately beneficial in moving the bowels, steadily aggravate the cause of the constipation.

PART 8

Blood Pressure and Flatulence

The object of any physical treatment should be to reestablish the normal rate of the circulation through every tissue of the body and primarily through the spinal cord and brain. This cannot be accomplished unless the systolic pressure is brought to 120, the diastolic to 80, the pulse beat full, regular, and 72, 66, or 60 in number, with no resistance to the movement of gas from the stomach to the lower bowel.

A patient may have an apparently normal blood pressure of 120 with a pulse of 66 or more and yet be suffering from hypotension because his pulse should be 60. The extra six beats per minute or the presence of incarcerated gas may disguise or compensate for an actual hypotension of the arteries. The writer has seen the blood pressure as high as 170 when the patient was suffering from extreme abdominal hypotension. This fact alone will explain many apparent discrepancies in blood pressure findings.

All are familiar with the fact that a man may have a normal or subnormal blood pressure and yet be suffering from extreme arterial hypertension. The failing strength of the heart explains the low blood pressure. Even if the pulse and the blood pressure are potentially normal, the retention of gas will produce all kinds of variations in the blood pressure and pulse beat. If the visceromotor nerves are irritable, the progress of gas from the stomach, where it is secreted, to the lower bowel, where it is reabsorbed, will be retarded at one or many places.

With many people with hypertension, *gas pressure and blood pressure are synonymous,* because the blood pressure comes to normal as soon as the gas is liberated. Even with some cases

of extremely high blood pressure or weak heart action, a single treatment which objectively liberated the gas brought the blood pressure at once to normal. The gas which causes so much disturbance is carbon dioxide and is derived by diffusion from the blood in the walls of the stomach.

Sometimes gas, especially when held in the stomach, will depress the force of the heart beat and make the pulse pressure as small as 10 or 15 mm., whereas the day before the pulse pressure was 70 mm. Neither the blood pressure nor the pulse tests indicate the strain put on the heart. The location and amount of the gas pressure add indefinitely to the work thrown on the heart. Every case of persistently irregular pulse in chronic conditions which the writer has treated was immediately due to gas.

With arterial or visceromotor hypertension, gas usually first slows a normal heart, the pulse becoming faster and weaker as the heart becomes unable to meet the increased resistance to the circulation. With hypotension the amount of gas is always excessive and increases the dilatation of the stomach and intestines, the muscles of which share the tendency of the arteries to relax.

With hypertension the pressure of the incarcerated gas has at first a tendency to cause the stomach and intestines to contract, but naturally dilatation will ensue if the contraction of the pylorus or any intestinal ring is extreme. No attention is usually paid to the gas until distension has been produced—but it may cause the highest blood pressure, with the most serious symptoms, without distension.

With hypotension the pulse rate is naturally increased on account of the lowered arterial resistance; afterward it may slow from weakness or accumulated gas.

When gas is held in the lower bowel, at first frequently the heart beats more heavily, to force the blood by the obstruction, but subsequently the heart action weakens. With many people the pulse varies uniformly with the contraction or dilatation and soreness to palpation of the stomach.

This increased throbbing of the heart may cause headache

or aggravate almost any symptoms. The movement of the gas may be retarded for years at any point of the alimentary tract, but it keeps steadily pushing through the obstruction as it accumulates sufficient pressure. The amount of disturbance of the circulation depends on the pressure of the gas. If it cannot pass through, the results are fatal.

Increased production and retention of gas occur in all fevers and acute conditions. Obviously, unless allowance is made for the fact that gas may cause any degree of depression of the heart action, blood pressure tests may be of little value. This incarceration of gas is usually responsible for the weakness and failure of the heart. The existence of valvular defects does not change the significance of any of the preceding facts but naturally lesions would cause an earlier failure of the heart action. These facts will explain the success and failure of many kinds of treatment of the circulation. Any drug which irritates the stomach and makes more gas is certainly contraindicated for circulatory disorders.

The fact that artificial inflation of the rectum with air raises blood pressure, is another illustration of the effect gas may have. The heart tries at first to overcome any increased resistance, but it should not be accepted as an axiom that it is often injurious to lower blood pressure to normal. Because it is often injurious to lower the blood pressure by means of vasodilators or hydrotherapy, it does not follow that it is injurious to reduce unnecessary resistance to the heart action.

When the proper spinal segments alone were treated, it has always been immediately and progressively beneficial to lower the blood pressure in every condition the writer has treated, even cases of apoplexy, and immediately after the beginning of the attack. Whatever increases intracranial pressure is in itself irritating and may increase the rise of blood pressure. The supposition that the kidneys or some other organ will not functionate if a high blood pressure is reduced, is the result of confusing blood pressure and the rate of flow of the blood. A rise in blood pressure above normal, unless the result of increased heart action, always represents increased resistance to,

and not an improvement in, the rate of flow of the blood. The extra force which the heart temporarily exerts to overcome some additional resistance often produces so much better blood supply to the brain that some patients feel particularly well just before some severe headache or other attack.

Since high blood pressure is often synonymous with high gas pressure, it follows that a vasodilator would have no relation to the cause of high blood pressure, whereas liberating incarcerated gas would be immediately beneficial and would relieve the work of the heart, sometimes enormously. The pulse pressure is 40 when the circulation is best. A failing pulse pressure indicates that the heart is unequal to the work thrown upon it, and it is a more exact indication of the rate of the circulation and of the seriousness of the condition than either the systolic or diastolic pressures alone. A high pulse pressure does not, however, indicate necessarily a more rapid general circulation. If the resistance to the circulation rises and the heart action is strong, the pulse pressure rises as a result of the extra effort of the heart to force the blood by the obstruction. Consequently one may have a pulse pressure of 70 and be suffering from a violent throbbing headache, because the heart is trying to force the blood against the extra resistance offered by the arterial and intestinal contraction in the lower abdomen or the resistance offered by the contraction of the pylorus and simultaneously contracted arteries in the same segment of the body.

Next to the physiology of the circulation, the most important fact of physiology to be considered is the constant movement of gas from the stomach, where it is produced, to the lower bowel, where it is reabsorbed. Trouble arises when the rate of production exceeds the rate of absorption, or, even with a very little gas, if it cannot escape from the stomach or if it reaches a portion of the bowel which contracts excessively because the visceromotor nerves are too intrinsically irritable, or if they are irritated by the presence of some foreign body or by a growth. When a large amount of gas is suddenly liberated through the pylorus, by a treatment of the controlling segments, the gas may pass through the entire intestinal tract inside of a

minute, but unless the amount of gas is large it will be reabsorbed and not pass from the bowel.

The rate of production of gas may be incredibly great. It may be belched up continuously for hours or may make a continuous purling noise as it passes out of the stomach, or through any contracted portion of an intestine. Acute indigestion results from the incarceration of the gas. The amount of gas may be independent of the food factor, except that too much or indigestible food may irritate the stomach and increase the formation of gas. Any amount, however, may be produced as the result of cold, fatigue, excitement, or mechanical treatment of the spine. In treating indigestion, acute or chronic, the primary consideration is to diminish the amount of gas being formed and to relax the contracting muscle ring, which holds the gas.

Excessive acidity of gastric contents is also a great irritant to the sensitive nerves of the mucous membrane and will produce any degree of contraction of the pylorus with contraction of other gastric muscles, or dilatation of the stomach if the pyloric stenosis is excessive; all of which inevitably causes some degree of general vasomotor disturbance.

From these facts it is easy to understand why many people have been cured of a great variety of chronic troubles by abstaining from those foods which produce the most acidity or gas; for the constant presence of excessive amounts of gas or acidity may sufficiently depress the circulation so as to prevent the recovery of any or all the nerve cells in the spinal cord and brain.

On the other hand, it should be remembered that any food will cause disturbance as long as the nerves to the digestive tract are very irritable. When these nerves are irritated by a depressed circulation or fatigue it is a dangerous misconception to attribute the symptoms to auto-intoxication or uric acid and to increase the irritability of the nerve centers by putting the patient on a too restricted diet.

Since gas is derived by diffusion from the blood vessels of the mucous membrane of the stomach, even when the disturbance is excited by undigested food or micro-organisms, spinal treat-

ment affords the most powerful method of controlling the flatulence and relaxing the cramp of muscles. The cramp occurs simultaneously with the extra formation of gas, because the vasomotor and visceromotor nerves involved start from the same spinal segments, and a marked vascular disturbance in any segment must disturb the functional activity of all the nerve cells located there.

This is the explanation of the flatulence with pneumonia. The lungs and stomach are innervated partly from the same spinal segments. There must be an active or passive dilatation of the blood vessels of the stomach to secrete gas. This dilatation may exist locally even with a general high blood pressure. The production of gas seems to increase as soon as the general blood pressure falls below 120 with anyone, with hypotension.

That some gas is always produced from the alimentary mass during digestion is, however, a fact which is certain; but the principal source of gas is from the alimentary canal. A proof that this secretion is independent of the coction of the elements is afforded by the fact that an hysterical woman will sometimes become tympanitic in ten minutes. Under our very eyes and hands we see and feel the abdomen attain a great size. Consequently the formation of gas is the result of disturbance of the nervous system, an increased secretion taking place in exactly the same way that there is, under similar influence, an increased secretion of tears, saliva or urine.—P. B. Crookshank.

Frequently, when the pulse and blood pressure are disturbed, there is no obvious disturbance of the digestion and yet the stomach may be so contracted and retracted from the abdominal wall that its condition at first is overlooked, but as treatment relaxes the cardia and the gas is belched up, or as the gas passes into the bowel, the stomach becomes more prominent and apparently more distended and finally relaxes to normal. This is because in these cases there is sufficient tone in the gastric muscle to prevent dilatation of the stomach. Stretching of a muscle or dilatation of an organ, as the heart or stomach, indicates that the muscles or the controlling nerve cells are unequal to the work put upon them. With hypotension of the arteries the stomach is always dilated and usually

lower than normal. As the irritability of the nervous system increases from overwork or malnutrition from any cause, the gas is held more and more frequently or continuously in the digestive tract. Its movement seems to be most commonly retarded at the pylorus, the ileocæcal valve, and the hepatic, splenic, and sigmoid flexures. The ensuing disturbance in the pulse or blood pressure seems always to be in proportion to the intensity with which the incarcerating muscles are contracting. In every case of irregularity of the pulse, even when associated with valvular defects in the heart, the immediate cause of the palpitation, irregularity, intermittence, or slowing of the pulse was the presence of incarcerated gas. This was proved absolutely, even in goiter and in advanced stages of arteriosclerosis, as well as in cases where no one could suggest a cause, inasmuch as the pulse became regular immediately after treatment had relaxed the contracted muscle and the gas had passed the obstruction; frequently this was obvious audibly as well as by palpation. That the actual resistance to the heart action is in the abdomen, even when there is valvular trouble, is a fact of enormous value, since it is a factor of great importance in every pathological condition; and usually this is the most important consideration. Even a small amount of flatulence may lower the temperature as much as two and one-half degrees.

PART 9

Relation between the Cerebral Circulation and Mental States; Physiology vs. Psychology

The following facts and quotations in regard to the cerebral circulation may be superfluous for some readers; but many of the facts are so frequently ignored by those treating mental and other nervous disorders that the writer wishes to emphasize as much as possible the physical basis of such conditions, and the relation between irritability of nerve cells in the brain and the rate of blood flow.

Mark Hopkins defined sensation as "the result in consciousness of any affection of the sensorium." If cells in the brain are irritated by anemia, it will produce the same results in con-

sciousness as irritation of the peripheral terminations of these nerves.

Generally speaking, it is little realized by the profession how great an influence aberrance of local blood supply has upon the mood, the mental poise, the capacity, and the physical *bienfaisance* of the individual. . . . I would like to emphasize the fact that vasomotor ataxia, a disturbance of the normal give and take relationship between different vascular areas, plays a more important part in many functional *as well as organic derangements* than is generally appreciated and that the subject merits more attention than it receives.—G. W. Norris, University of Pennsylvania.

Abnormal mental feelings in people who have previously been normal are just as much a physical symptom of a disturbance of blood supply as the pain of headache.

A sluggish circulation always accompanies a poor intellect.—*N. Y. Med. Jour.*, Mar. 30, 1907.

One golden rule of mental therapeutics may be here recalled, that the cure of the sick body or exhausted nerves must precede the cure of the sick mind; in fact, the physical must go before the psychical.—A. T. Schofield, M. D.

It is not the quantity of the blood constantly present in the cranial cavity, but the quantity propelled in a given unit of time through the vessels of the brain, which determines the nutrition and proper function of the living cerebral substance.—Wm. B. Cadwalader, M. D., in *Journ. Amer. Med. Assoc.*, May 2, 1914.

We are familiar with the effects of the constantly occurring variations in the caliber of blood vessels in most tissues of the body, but much less attention is paid to the far greater effects which follow similar variations in the caliber of the vessels of the spinal cord and brain.

Hyperemia. Under ordinary circumstances, the circulation of the brain follows passively the general bodily conditions. When anything increases the force with which the blood enters the skull—i.e., when blood pressure is raised either by increase in the heart's action or by general vasomotor effects, more blood passes through the brain in a given time, and it is, as it were, flooded with blood. This active hyperemia must occur under many circumstances, but it is doubtful if it causes any symptoms; in fact, it is difficult to see how it, in itself, can do anything but good.—Osler.

It is the *rapidity of blood flow* which is beneficial, but if hyperemia is a result of a rise in blood pressure from contraction of abdominal or other blood vessels, and if this increased resistance to the heart action slows the rate of the circulation to any extent, the nerve cells of the spinal cord and brain, generally or locally, at once begin to suffer from this diminished rate of nutrition, just as they would from anemia from low blood pressure. This is proved almost daily in relieving cerebral symptoms at once by relaxing abdominal contractions. As the blood pressure returns to normal, the pulse becomes strong and, though the quantity of blood in the brain may be the same, there is a more rapid flow of blood through the head on account of the stronger heart beat.

In this book, the term "hyperemia" is applied to local vascular dilatations when the general arterial tension is above normal. If nerve cells are weak and irritable, an increased and constant resistance of only 10 mm. to the heart action will appreciably impair the nutrition of these centers. This is proved by the improvement in the strength of these centers following a reduction of the blood pressure to normal; but here, as elsewhere, it must be remembered that a temporary rise in general blood pressure from exercise, or eating, may improve only the nutrition of the brain. *It is the increased rapidity of flow which is beneficial.* A contraction of the abdominal blood vessels above normal does not improve the rate in flow unless the heart is continuously equal to the extra work. If the blood pressure is below normal from relaxation of the abdominal blood vessels, a rise in blood pressure to normal, by contraction of these vessels, would improve the circulation through the brain, if the heart action is normally strong.

"Anemia" is the term which will be used when there is a slowing of the rate of blood flow through the brain and cord, due to lack of tone in the blood vessels, especially the abdominal (passive hyperemia).

If there is a hyperemia in a local area of the brain or spinal cord, even though the blood pressure and pulse are normal, there will be necessarily an impairment of the nutrition of the nerve

cells locally as a result of the relaxation of the arterioles, which would cause a slowing of the circulation in this area.

Anemia of the brain or cord is a most powerful irritant and may produce any pain or sensation which can be excited by peripheral stimulation. Therefore, no one with the popular ideas of "hysteria," "neurasthenia," and the like, would so graduate treatment as to relieve the most sensitive patients. In treating all kinds of mental and "nervous" disorders it becomes evident that the mental feelings vary absolutely with variations in the rate of blood flow. Until the physical causes of the variations in cerebral blood supply have been relieved, the treatment of nervous conditions by psychic methods alone may be only a method of adding to a patient's suffering.

The effects of spinal treatment cannot be produced accurately unless, as already stated, the proper kind and amount of treatment are given for the proper segments. This enables the operator to eliminate the "mental effects" of treatment. The wrong amount or kind of treatment will produce uniformly wrong results, even if one holds the popular therapeutic misconception that the effect of all treatment is mental.

A striking illustration of the tendency to ignore physiology in the treatment of nervous troubles, is the fact that "Perkins' Tractors" are classified by nerve specialists and in encyclopedias among historical forms of mental suggestion. Drawing metal rods over the skin, at least along the spine, may produce a very powerful vasoconstriction and for cases of local or general hypotension, may produce the most beneficial results; indeed a small bottle, filled with cold water, drawn down the spine may do more for a case of hypotension than any drug which could be put into the bottle or the stomach. To classify these results as "mental" makes any study of physiology unnecessary. Since a cold spinal douche can produce powerful effects on the blood pressure, pulse, or any vasomotor or visceromotor mechanism, the following quotation from "Nervous and Mental Diseases" (Church and Peterson, 1908, p. 646) illustrates how physiology is often ignored in treating nervous diseases.

The management of nocturnal enuresis. . . . Finally, a strong mental impression is of greatest value. For instance, Prendergast cured seventy-five out of eighty in a boys' orphanage within a short time, by giving them a cold spinal douche followed by a quick rubbing down just before getting into bed. Nothing else whatever was done and the five remaining cases were much improved. In some cases the first douche had the necessary effect and the *mind* remained on guard.

Except when due to injury or destruction of brain tissue, all mental disorders, phobias, obsessions, depressions, or excitable nervous states, whatever the immediate cause, are the result of acute or chronic malnutrition of the brain. This malnutrition may produce an infinite irritability of any part of the brain. These irritable intellectual centers may be thrown into violent activity by any stimulus, physical or psychical.

If the mental state is the result of some emotional strain or shock which disturbed the blood supply to the brain, the trouble may disappear as soon as anything restores the normal blood supply to the brain. If, however, there is actual nervous fatigue and therefore expenditure of nervous tissue, it will take time for the nerve cells to recover, even after the circulation is normal. The most phlegmatic, unemotional washerwoman, if an attack of flatulence so interferes with the circulation as to produce anemia of the brain, may in a few minutes feel unable to think, become terrorized, and imagine she is "going crazy." If the trouble has only recently begun, a little spinal treatment relaxes the abdominal tension, the pulse comes to normal, and the mental suffering is relieved. If, however, this condition of the circulation continues, even in a slight degree, any phobia or obsession may develop, according to the patient's disposition and experiences, and in time become established. If the disturbance of the circulation is the result of years of nervous fatigue, it is obvious that the fatigued centers in the brain will not recover until the normal circulation has been maintained some time. It is this fatigue or starvation of the central nervous system, including the vasomotor system, which makes two distinct pathological classes of nervous patients. No amount of mental suggestion, mental "cathartics," bulldozing, or physical violence can restore at once the expended energy and lost tissue

to fatigued cells; whereas if a nervous trouble is entirely the result of a vasomotor disturbance and the fatigue factor is absent, these methods may succeed. No amount of mental training can dispel a phobia if the brain is anemic from low general blood pressure following exhaustion.

In view of the infinite irritability of part or all of the central nervous system which results from fatigue or from disturbance of the circulation, we see the physiological reason for the principle of "nonrestraint" in treating the insane, so ably set forth in the work of Beers, "The Mind That Found Itself." This book, now recommended by leading nerve specialists, should prove, in view of preceding facts, that the brutal methods often used in the treatment of phobias and other nervous troubles are quite as illogical as much of the treatment of the insane.

If a patient has some strong phobia, but has at the same time a fair general vascular tone, forcing the patient to overcome this phobia at some special time may at once remove the fear, because the patient finds that there were no evil consequences from doing the dreaded act. If, however, the phobia is associated with great vascular instability, and the patient is forced to cross over a bridge, or pass through a tunnel, or go down an elevator, it may produce a serious disturbance in the circulation which may persist for an indefinite time, aggravating all mental and physical symptoms and resulting in most serious consequences to the patient. The well-meaning but brutal psychologist does not know enough physiology to realize the cause of the calamity, or to understand the effects of his folly, or to suggest a remedy for the results. By observing the effects of some mild excitement on a patient, noting the change in the pulse, in the blood pressure, and the contraction of gastric, abdominal, and intestinal muscles, any such blunders may be avoided or at least their bad effects may be overcome by treatment.

The treatment ordinarily given for syncope (fainting) is not mental, but purely physical and mechanical. Similarly spinal treatment affects the blood supply to the spinal cord and its vasomotor centers and therefore to all the body, and this action is just as independent of the patient's mind as the action of

gravitation in restoring the blood to the brain of the man who faints.

This is not to deny that worry and discouragement depress the circulation and that hope, interest, confidence, and pleasure improve the general circulation and are valuable aids to recovery, but treatment will produce its effect in babies, and in the depressed and skeptical, and even in the delirious, just as certainly if not as rapidly as in the most hopeful and gullible. Indeed, the most remarkable results have been obtained in people who declared that they were absolutely and logically incredulous after years of more or less injurious experimental treatment. Usually patients have begun treatment merely to please some friend or relative.

Very frequently treatment will restore the heart action to normal at once, when the patient does not know whether the pulse is slow or rapid. Improperly given treatment will aggravate the cardiac disturbance regardless of the mental attitude of patient or operator. While the blood pressure, temperature, or pulse can usually be brought to or at least toward normal at once, in treating most chronic conditions, these results cannot be produced unless the proper kind and amount of treatment are given over the *proper* segment or half segment. In this way the mental effect is entirely eliminated.

It must be remembered that the intensity of all ideas is dependent on the irritability of the brain cells, because the cells of the brain are like all the cells of the body in this respect, and irritability depends on the rate of the circulation. Therefore, in cases of extreme emotion, it may be just as absurd to expect the patient to control the congestion of the brain as to expect a man to control the congestion of his feet in gout or gangrene. The proper use of treatment which relieves the anemia or hyperemia of the brain will relieve intense excitement or other emotion. Indeed, sometimes great mental effort at self-control might add to the disturbance of the cerebral circulation, because mental effort dilates the blood vessels of the brain or of the abdomen, if one has hypotension.

Fear, excitement, or other emotions may produce profound

physical disturbances, but it should be remembered that these results, if they persist, are due to the disturbance produced in the circulation and even if the symptoms are entirely mental or subjective, the disturbance is physical and should be treated physically. When the normal circulation is reestablished, the mental disturbances disappear, just as a swelling or redness of the skin disappears if the circulation can be reestablished. The effect of the mind on the body is being sufficiently emphasized in modern literature, for example:

> Fear, which is mental pain, causes greater acceleration of the heart, greater vascular constriction, and greater pallor than can be induced by mere physical pain. Not only is the circulation profoundly affected, but there is a tendency to irradiation beyond the cardiac and vasomotor into all the splanchnic functions—profuse perspiration, haripilation and movements of the abdominal and pelvic viscera which can rarely, if ever, be reflexly induced by any degree of peripheral stimulation.—A. T. Schofield, p. 228.

This explains the serious consequences which may follow a fright, but these consequences and all resulting nervous disorders may be relieved by restoring the nutrition of the cord and brain. Since a heated argument may considerably raise the blood pressure, we see the value of learning self-control.

There is a very general tendency to classify all diseases as physical or mental; and to call all conditions which are not the result of injury, infection, toxin, tumor, etc., "nervous," "neurotic," "psychic," or "hysterical." For example, Crookshank in a previously mentioned monograph on "Flatulence," said he was satisfied to call excessive amounts of flatulence "hysterics" until he had an attack himself. He then discovered the physical cause for flatulence.

Similar illustrations might be given to show that the tendency to call a symptom hysterics may prevent any study of physiology. The psychological explanation of whatever is not understood is easy and largely a matter of vocabulary. The idea that the mind affects the body is not new. Solomon said, "A tranquil mind is the life of the flesh," but the Bible also teaches that even the prophet Elijah when fatigued by his flight from the hired assassins of Jezebel became so mentally depressed as to

wish to die, until his strength had been renewed from food. If the blood supply to the brain is sufficiently disturbed, anyone may feel apprehension, or become delirious or unconscious.

The cures obtained by psychotherapy or by relieving the mind of some anxiety will not be discussed here. These results are being sufficiently advertised. There is greater need of emphasizing the physical basis of nervous disorders.

Since in the head are found the nerve centers which control the action of the heart, lungs, and all the digestive organs, even as far down as the intestines, and also centers which control the blood supply to all these organs and to every part of the body, and the centers which control the action of all the voluntary and involuntary muscles of these organs and of the limbs and the face; and since the health and activity of all these centers depend on their blood supply, it is easy to understand the bad effect of excitement, worry, emotion, and the like, which congest the head or aggravate its anemia and so disturb the normal activity of these centers. On the other hand, it is evident that hope, self-confidence and, most of all, perfect faith in God, would have a beneficial effect on the circulation.

Riding on the cars, in addition to the diversion, to which all the results are usually attributed, relieves the cerebral symptoms of many patients, because the vibration contracts the cerebral vessels and improves the circulation, raising the blood pressure and relieving the anemia of the brain of those with hypotension. Fatigue would increase the hypotension finally.

Since the intracranial pressure varies with fluctuations in the atmospheric pressure, we can understand some of the headaches, depression, and other cerebral symptoms occurring in some sensitive people before storms and other barometric and thermometric changes.

In regard to many cases of so-called hysteria we should remember that any irritation of the cerebral cortex may cause all kinds of subjective as well as objective symptoms and one of the most powerful and common irritants is chronic anemia. One should cure the anemia before blaming the patient.

Since there can be no mental activity, conscious or subcon-

scious, without blood, the vasomotor factor should receive primary consideration instead of being so largely ignored. There may be so great an irritability of a part of the brain that the patient feels like screaming every moment, unless he makes a constant effort to fasten the mind on some other line of thought. As soon as he relaxes this effort, the fixed idea will become dominant. This is commonly said to be located in the subconscious mind; it is obviously the result of an excessive irritability and therefore overactivity of some part of the brain. High authorities may be quoted to prove that no one should be labeled hysterical simply because "our crude methods of clinical investigation" fail to indicate the cause of the pain.

The causes of hysteria given in works on nervous diseases include severe mental and physical shocks, severe illnesses as typhoid or grippe, or various drugs.

The causes of hysteria could all produce serious variations in the cerebral blood supply and the resulting malnutrition of part or all of the brain would account for any lack of self-control. Any emotional shock or any sharp blow on any part of the body may be sufficient to raise or lower one's blood pressure. If the disturbance in circulation persists, it gradually weakens, or increases the irritability of, any nerve cells in the spinal cord or brain, producing almost any mental or physical symptom. If the disturbance in the circulation is great, faintness, dizziness, mental depression, indigestion, or any other symptom may develop rapidly. If the disturbance is slight, the symptoms may develop very gradually. The rapidity depends on the vitality of the patient's nerve cells and the change in the rate of the circulation.

Any mental excitement or physical treatment which restores the normal sensitive vascular equilibrium, may at once cure the symptoms; if, however, the vascular disturbance had persisted until the nerve cells were starved out, or if such symptoms are the result of nervous fatigue from years of overwork, mental shock cannot cure the patient; at least, unless there has been a period of rest and perhaps unconscious recuperation.

Some of the most distinguished neurologists have told the

relatives of patients who they admitted were "worked to death" that a sudden fright would cure the patient. This is as absurd a prescription as saying to a financial bankrupt that a fright could make him a millionaire. Both physical and financial bankruptcy require time for their cure.

It has been determined that, as a result of fatigue, nerve cells become actually smaller, through a loss of substance, and that rest is essential to reconstruction of lost tissue. Prolonged overwork leads, therefore, to atrophy and degeneration. In view of these facts, treatment of hysteria and other nervous troubles may be extremely cruel.

Spinal treatment, which restores the normal rate of the circulation, and accelerates the rate of restoration, is rather more logical and successful than attempts to frighten the effects of fatigue out of a patient by using a red hot poker or personal insults or insinuations.

The normal irritability of the spinal cord is dependent upon the continuance of the normal circulation, and this irritability of the cord is indicated by the contractions of the spinal muscles. Some areas are usually more contracted and sensitive than others, but why should one part of the spine have hysteria and not another? Even the fact that many patients with railroad spine have recovered as soon as the delay over the lawsuit for damages was ended does not prove that there was not a vascular disturbance in the spinal cord. It only proves what all admit, that worry can cause and maintain very great disturbances of circulation.

Painful sensations, even a slight cutaneous irritation, or disagreeable odors, or bitter or sour taste, or optical or auditory irritation cause more or less change in the general blood pressure and a simultaneous dilatation of the cerebral vessels. This dilatation of the cerebral vessels would explain the intense and sometimes prolonged suffering (usually considered imaginary) which is endured by extremely sensitive patients when subjected to some slight cutaneous pressure or other irritation of sensory nerves. The physical effects of the disturbance in the circulation are not imaginary, even when the hypersensitiveness

was largely established through faulty training or lack of self-control.

Some patients have such sensitive skins that they suffer exquisitely unless they have a soft bed; the pain produced by contact with a hard bed may so disturb the circulation as to keep them ill.

Before the writer's spinal trouble was relieved, enduring the pain caused by sitting for half an hour on a hard chair often so aggravated the anemia of the brain that it was several weeks before he recovered from the distressing results.

The sensory activity of the skin center is, through constant external education, much higher than that of any other part.—Hilton, p. 211.

When there is increased sensibility of the nerves transmitting painful impressions, even slight contact with the skin, or a mere breath of air upon it, may cause the most violent pain (cutaneous hyperalgia) especially in the presence of inflammatory or exanthematous conditions of the skin.—Landois, p. 935.

Because the centers in the cortex are connected with the vasomotor centers in the medulla, any mental excitement may disturb the activity of the vasomotor centers, and there will be a consequent dilatation of the blood vessels in any tissue, chiefly wherever the vasoconstrictor nerves are weakest. Hence, excitement causes some people to flush in the face; others perspire because the blood vessels in the skin, supplying the sweat glands, dilate; others may have diarrhea or an excessive flow of urine according as the blood vessels dilate in the intestines or kidneys; others will faint if the excitement is sufficient to dilate the large abdominal vessels. If the cerebral or the vasomotor nerve cells involved are very irritable, no one can control either his own vasomotor disturbances or the mental excitement.

Some people endure much mental suffering because they blush from the slightest excitement, and the trouble is called "mental," and the patient is blamed for lack of self-control. This excessive blushing is no more mental than perspiration or diarrhea, because excitement causes the one in some people and the other in others—wherever the vasoconstrictors are weakest. The gravity of the symptoms depends as much on the weakness

of certain local arteriomotor mechanisms as on the degree of excitement. The increasing sense of anxiety, fear, or terror, which is felt by neurasthenics with low blood pressure is the result of anemia of the brain. Whatever increases this anemia will aggravate the fixed idea.

If any part of the nervous system has become very sensitive through years of weakness and local irritation, as soon as the circulation is depressed from any cause, the pain or hyperemia in the sensitive cutaneous area at once may become very intense. If one is weak, a few minutes of reading or the slightest exertion will aggravate any symptom and it is unphysiological to dismiss such symptoms as "nervousness," "hysteria," "neurasthenia," "hyperasthesia," when there is a chronic malnutrition of the sensory, vasomotor, or other nerve cells.

If a man has overworked for a number of years, has fatigued the whole nervous system and incidentally made a reputation as a hard worker, and is so full of incarcerated gas that he cannot stand up straight because his blood pressure is only 80-90 mm., it is unjust, cruel, and a most improbable diagnosis to call the trouble "psychic," unless we pronounce the word "sickick," for there is always sufficient vascular disturbance to account for the nervous symptoms if one is interested in physiology. It is a diagnosis which only a very healthy, or a very ignorant, or a very celebrated neurologist would have the temerity to make. The adjective "psychic" may be quite as irrelevant when applied to many other conditions where the vascular instability is less evident.

Chronic conjunctivitis clearly illustrates the vasomotor changes which may occur in any tissue of the body and may therefore explain the vascular variations in the spinal cord and brain, if, for example, it is a case of hypotension. Whenever the blood pressure falls still lower, the conjunctivitis is immediately worse; use of the eyes, which would naturally somewhat increase the hyperemia, causes the greatest hyperemia when the blood pressure is lowest.

Actual hemorrhage of the retina has followed a fall in blood pressure as it more frequently has followed a rise in pressure.

This is simply an exaggeration of the chronic hyperemia. Exacerbations of the intensity of so-called "mental tics," or any chronic spasmodic muscular contractions, and the intensity of abnormal ideas of neurasthenics occurring with hypotension are all obviously aggravated by anything which slows the rate of blood flow through the brain.

This law is just as true of irritable intellectual areas in the brain. From personal experience during a number of years with low blood pressure, the writer learned that a fixed idea is aggravated by whatever depresses the rate of blood flow through the brain, and conversely, the intensity of the idea is diminished by whatever improves the cerebral circulation.

Verworn has shown that stimulation of a nerve which produces contraction of a muscle, simultaneously produces inhibition of the nerves controlling the opposing muscles. This law applies in a large way to mental stimulation of nerves controlling muscles or even of cells in the intellectual areas of the brain. For years the writer had a condition (from low blood pressure) of great irritability of nerves controlling certain spinal muscles. The muscles would contract painfully from very little fatigue or excitement, but by violently contracting other muscle masses he could diminish, postpone, or relieve the painful cramp, the response depending on the degree of irritability of the weak cells. When the irritability was greatest little relief could be obtained; when the nerves were nearly recovered entire relief could be obtained.

In cases where there is excessive irritability of some motor or intellectual areas of the brain so that some tic results or some phobia is continuous and dominant, by throwing some other area into activity voluntarily the activity of the excessively irritable cells is inhibited, at least temporarily. As the affected area becomes less irritable from improved nutrition, it is proportionately easier "to divert the mind," but when the irritability is extreme all mental effort may be useless.

Those whose cerebral nerve cells are not uncontrollably irritable may reach a very complacent mental condition, supposing that anyone can control the nervous system by mental effort,

and thenceforth by their advice add to the sufferings of those who have already displayed the greatest will power by driving the nervous system to a point of fatigue from which nothing but necessary and judicious rest and treatment can save them. For them, any exertion, mental or physical, may cause a greater and injurious fall or rise in the blood pressure.

With some patients who are sufficiently philosophical to regard their emotions and sensations objectively, it can be determined, by careful blood pressure and other tests, at what point they will begin to feel dizzy or feel like shedding tears or cannot control some phobia.

Any long illness increases the irritability of the brain cells and therefore the intensity of one's sensations. This is partly the result of the absence of the ordinary work of the brain and, since the brain must be continuously active, its attention is turned to the sensations, in the absence of something more profitable. Abnormal intensity of the sensations may therefore be due to this mental attitude or to excessive irritability of all the nerve centers. This irritability is due to the vasomotor changes affecting the blood supply to the brain, following any physical or mental suffering, aggravated frequently by fatigue. Both physical and mental suffering powerfully disturb the circulation. Increased sensitiveness, for example, of areas in the skin, may be excited by vascular irritation (anemia) of the central end of the nerve as well as by mechanical irritation of the peripheral end. The mind can have only one idea at a time uppermost, and just in proportion as the mind is not engaged with objects and ideas connected with the outside world, the subjective sensations become more intensified. For this reason the "rest cure" should be carried out very cautiously; the bad effects may be imperceptible but they are inevitable. While perhaps only a limited number of people have been made to suffer extremely from the rest cure, still others have been so seriously affected that the method should be classed with risky operations for many people.

It is a function of the will to inhibit reflexes, sensory and emotional, as well as motor. While in some cases there is a lack

of will power from faulty training, the inability to control reflexes is more often the result of the increased irritability of the automatic centers.

The history of a large proportion of nervously exhausted people will prove that will power has made invalids of more well people than well people of invalids. Strong-willed people drive the subordinate centers to exhaustion before they consider their feelings. Few people can endure for many years the modern strain either of business or pleasure seeking. When part or all of the brain becomes excessively irritable, it is like having a dual personality. The normal logical part of the brain can suggest hopeful, quieting, trusting ideas to the irritable, exasperated, fearful, and unduly emotional part of the brain, but whatever increases the vascular disturbance in the brain will make these suggestions less effective. If the vascular disturbance reaches a certain degree, the suggestions have no effect whatever. As the strength of the vasomotor nerves improves, these suggestions become more and more effective. It is cruel ignorance to expect a patient to control abnormal ideas by will power, if the patient has made a hard fight and lost.

As the result of long continued fatigue or anemia of the cells of the brain, a man may develop some intense apprehension or phobia, as, for example, the fear of death; this fear may be so intense as to be always in the mind, but it will be more intense at one time than at another, and the intensity will vary with the rate of the circulation of the blood through the brain, independently of external causes though of course the fear will be increased by suggestion of the idea. If such a person has been subjected to a number of emotional shocks during this period of cerebral anemia, certain areas or association pathways are left in a more sensitive condition than others. If the anemia is marked, one of these abnormal ideas will constantly be occupying the attention, but only one. If the man has great control, he may by great mental effort turn his attention from one to another of these ideas, and sometimes a less horrible fear may be substituted for a worse one. Outside events or fresh shocks may turn the attention from the first intense phobia to another,

but in the absence of great mental control or fresh shocks the original terror will persist.

Whatever accelerates the rate of blood flow through the brain will for the time diminish or relieve any or all of these terrors, *e.g.*, exercise, if sufficiently active, and if the cerebral irritability is not too great, will, for at least some hours, relieve the feelings. If the fatigue involved was so great as to increase the cerebral anemia, the feelings will recur with greater intensity after the exercise. If walking is too slow, gravitation may so aggravate the anemia of the brain as to increase the mental suffering of those with hypotension. Talking or other excitement or mental effort may temporarily give the same relief by accelerating the blood flow through the brain, followed by a recurrence or exacerbation of the feelings proportionate to the fatigue involved.

Whatever retards the rate of blood flow through the brain, immediately aggravates the uppermost terror. Cold air by contracting the external blood vessels, when the heart is weak, may, by slowing the circulation, intensify the idea. Indigestion by disturbing the heart action or the blood pressure, may intensify the idea. Hot weather by dilating the blood vessels in general and especially in the affected area of the brain, may intensify any existing phobia. Rest, by relaxing the blood vessels and slowing the heart action, may intensify the fear; in cases of extreme loss of vascular tone, the fear may become uncontrollably intense as soon as one lies down because the circulation is slower. An altitude of only 2,000 feet, by raising the resistance to a weak heart action, may intensify the idea; sea level, by lowering the blood pressure, will intensify the feeling also, if hypotension exists.

The phobias of many patients will always subside or disappear during any attack of indigestion. Similarly, to some extent, wounded soldiers do not have the nervous symptoms of those who are shell shocked. Evidently the brain does not intensely feel mental and physical pain simultaneously.

When a "phobia" is uppermost, even some violent and unusual physical exertion, to which one is not accustomed, may cause no muscular lameness at once, but only aggravate the

phobia, after the immediate acceleration of the circulation has subsided. Patients who are unable to observe and analyze their sensations may have so intense a phobia or obsession as to make them oblivious to actual physical injuries. The intensity of all these physical pains and abnormal ideas depends on the irritability of the nerve cells and the rate of blood flow through part or all of the brain. If the disturbance of circulation is limited to some particular part of the brain, and the general circulation is strong, any great mental effort or exertion, or shock, or mental suggestion, or diversion, may entirely relieve the mental or physical pain. If, however, the cerebral anemia is unrelieved these attempted or accidental shocks will only intensify the old idea or make other cerebral areas hypersensitive to any mental or physical cause of variation in the cerebral circulation. Since fatigue affects chiefly and primarily the most sensitive areas in the brain, it shows the danger of prescribing "more exercise" or even fatiguing "diversion" to relieve phobias or obsessions in those whose vasomotor nerves are exhausted.

The sight of appetizing food excites a nervous reflex and stimulates the flow of saliva; this is the effect of a purely psychic stimulus. If the response to any stimulus, psychic or physical, is excessive, it indicates that the particular nerve cells involved are excessively irritable; and this irritability is increased or decreased by the causes previously mentioned. This irritability, if excessive, should be reduced by treatment and a patient should not be expected to control entirely by will power what may be quite uncontrollable. The injurious effects of fright or any undesirable mental suggestion depend on the amount of vascular disturbance produced. If the brain cells are very irritable and the vascular instability very great, there will be the greatest vascular disturbance and resulting nervous symptoms. Just as the amount of vascular change produced by a definite amount of spinal pressure is an exact test of one's vascular stability and strength, so also the amount of vascular disturbance produced by fear or other excitement is an indica-

tion of the irritability of the brain, or of vascular instability, or of both.

When the emotional or subconscious, or irresponsible part of the brain becomes uncontrollably irritable and dominates the will, it very nearly resembles demoniac possession; the demon reveling in asserting its power and authority. It is a great aid to recovery if patients can be brought to look upon these manifestations as a separate personality, frequently most devilish and quite distinct from their usual character. But if the condition is extreme, argument or suggestion is useless; the physical condition must be changed before the patient can begin to cooperate.

It must be remembered that the cause of excessive irritability of the nerves is always physical, whether the irritability is within or beyond one's control. If a patient with insomnia has in addition an intense fear of not sleeping, it is a great relief when he sees that insomnia is due to irritation of the brain, the result of a disturbance of cerebral circulation, which can and should be cured by proper treatment, and that it is not the cause of the illness. It is a serious error to treat insomnia as a cause; it hopelessly misdirects the attention and efforts of everyone involved. This fear of insomnia may perhaps drive the patient to the most extreme and desperate efforts to escape noises, whereas the noises might be unnoticed if the patient were well—within limits, of course, for it is absurd to expect the patient's irritable auditory centers not to be disturbed by any noises. But the fear of insomnia may make the patient insist upon the decapitation of all the roosters within a radius of several miles, the lubrication of all fence gates for two blocks, and the stopping of clocks, or of other people's life work; or, in short, the lubrication of the universe. Essentially this demoniac spirit is the same in all phobias—a desperate determination to do anything to avoid exciting or increasing the fear. Therefore patients should be shown that giving way to any illogical wish or feeling is the opening up of a bottomless pit of devils, and it is far easier to choke off the first devil; making concessions avoids immediate suffering, but is dangerous.

Those who have been taught self-control in infancy and childhood are least likely to give way to this feeling.

However, it is also true that people with the most self-control are most likely to ruin the nervous system, if they try to ignore their feelings and the laws of health. They may therefore bring themselves into the same condition as the most selfish and uncontrolled.

When a phobia is established, it must be remembered that the condition is as much physiological as a variation in the functional activity of any other cells in the brain or spinal cord. The physical condition must be improved before expecting the patient to overcome the phobia. Otherwise failure will discourage the patient and intensify the fear. Forcing a patient to do what he most dreads, and what therefore will cause the greatest excitement and shock, may be the greatest cruelty and folly and only exaggerate the trouble. If a patient can realize that the phobia is intensified by any increase in the circulatory disturbance in the brain, he will have less fear of the external occasions and will see the need and possibility of curing the physical cause. So far as an analogy can explain any psychological fact, the situation might better be described in electrical terms as an increased difference in potential between the inhibiting will power and the more or less automatic subordinate nerve centers. In one class the will power may be insufficiently developed, in the other, the irritability of the automatic centers is so increased as to be beyond the control of the will power. While the symptoms are similar, the causes are not, and the latter class deserves the utmost consideration. The injustice results from treating the two classes similarly.

Even when hysteria is due to faulty training, the patient is not the guilty party and it is also true that the condition is largely pathological, since the vasomotor mechanisms for the particular areas involved, are extremely irritable. Certainly the results of a few days' treatment on some children who were extremely irritable, hysterical, and sleepless proved that in their cases at least excessive irritability was pathological and not psychical.

Occasionally the fixed idea of some patient seems to be a determination to be ill and to prove that nothing can help him; even here it is a question how far this trouble should be considered mental; it only is more difficult to cure than other fixed ideas, for, from the nature of the case, the patient will never cooperate as he might if he were anxious to escape from suffering.

It is the greatest possible shock and cause for additional irritation when a person of great will power and energy discovers as a result of years of overwork that he not only cannot drive the body and mind to do the usual work, but that he is absolutely at the mercy of some absurd fear or emotional disturbance. If then he is told by a neurologist that his trouble is due to lack of self-control or hysteria, or some other apparently opprobrious epithet is applied to him or his condition, his misery is complete and profound. If the slightest degree or suggestion of physical restraint is added to the already infinite irritability of the nervous system, we have then the shortest road opened to the padded cell.

All such mistreatment is based on a misconception which is "fundamental, colossal, ghastly, and inexcusable." The situation is similar even when this irritability exists in some musculomotor nerve centers, as for the facial or cervical muscles. When the irritability reaches a certain degree no will power can control the twitching.

For a man with extreme anemia and fatigue of the brain it may require incomparably more will power merely to keep from crying or screaming, or perhaps from swearing than was required to perform the most arduous and prolonged mental or physical work in the past. If in health, "He that is slow to anger is better than the mighty and he that ruleth his spirit than he that taketh a city," it is certainly far more true in neurasthenia. Should this be called "lack of will power," if the patient had previously lived a normal life of activity and enterprise?

Many times the writer has seen people suffering from apprehensions, mental depression, and phobias, with the pulse depressed ten to twelve beats per minute or considerably acceler-

ated, and the blood pressure 10 to 20 per cent below normal or 30 or 40 per cent above normal, and as soon as a treatment has brought the pulse and blood pressure to normal, usually by allowing gas to escape from the stomach or some intestinal loop and so relieving the obvious anemia of the brain, all of these abnormal feelings have disappeared at once. In a few cases one treatment cured conditions of low blood pressure and depressed feelings which had existed several years.

Conversely, these abnormal feelings can be immediately reestablished by reversing the spinal treatment or by cold, fatigue, excitement, or anything which disturbs the vascular equilibrium.

If one in this condition of general vascular relaxation feels depressed and like crying, yielding to the emotions to the point of shedding even a single tear may lower the blood pressure and start up the most intense irritation of the brain lasting often days and even weeks. If the blood pressure is above normal, crying may relieve the irritation of the brain because crying would lower the general blood pressure, but the results depend also on the tone of the cerebral vessels. Losing control of the emotions even for a fraction of a second over any mental source of irritation, may produce the most extreme and prolonged mental or physical disturbance. A purely psychic stimulation may cause a brain storm, but so also will the vascular variations however produced. The vascular variations can be at least gradually controlled by the physician, but not if he treats patients entirely from the psychological viewpoint. Any degree of discouragement, disappointment, mental irritation, or anger, instantly increases the existing vascular disturbance. The brain cells may become so sensitive that any idea is irritating or can be made irritating by the devilish perversity of the brain. This fact is sufficient explanation of the beneficial, preventive, and curative effects of all systems of healing—religious, scientific, or even the most idiotic system of self-control or mental suggestion.

The fact that the blood pressure will fall in proportion to the mental effort or worry if one is weak from hypotension, will

explain why tremors and phantom tumors due to excessive irritability of the nerves to the intestines may be worse as soon as the patient is worried about them, or even tries to control the tremors.

A patient when improving may feel more relaxed and apparently weaker after sleep; and using the brain when relaxed or the sudden exertion of rising, may cause greater circulatory (cerebral or cardiac) disturbances than when the patient was worse and under greater nervous tension.

When a patient with hypotension feels exhausted immediately after listening to music or talking, it may be because in addition to some fatigue the emotion has dilated the abdominal vessels, and the time required to recover from such efforts depends on the weakness of the patient and the severity and duration of such a dilatation.

Ideas are more intense at night not only because there is nothing to divert the mind in other directions but because the horizontal position and resulting vascular relaxation may dilate the cerebral and abdominal vessels and slow the circulation thereby irritating or exciting the brain. Premonitions of dying, which have "come true" could be the natural result of the depressed circulation which culminated in physical collapse.

The word "hysteria" has been used so extensively to account for anything which was not understood that it reminds one of the old lady who said "Moses" whenever she came to any proper name in the Old Testament which was hard to pronounce. The word "hysteria," like "neurasthenia," "ideopathic," and "essential," has been of more value to the medical profession than to the public.

Mental or emotional disturbances are just as necessary results of vasomotor changes in the cortex of the brain as tics and other spasmodic muscular contractions may be of similar vasomotor disturbances in the motor areas. If there is a perfectly stable circulation in every part of the spinal cord and brain, we then only may fairly blame the patient for lack of self-control.

The feeling of apprehension or fear which may be the first

mental symptom of disturbances in the cerebral circulation instead of being disregarded, should be considered as much a physical symptom as pain in rheumatism, and far more serious, and should be utilized to make the patient live a more hygienic life.

PART 10

Anemia or Hyperemia of Local Areas of the Brain

The different treatments required for different spinal segments prove that the blood vessels in one part of the cord may be more dilated than those in another, and it is not an unreasonable supposition that similar variations occur in the brain.

If there should be a loss of tone in any vessels of the cortex, the nerve cells supplied by these vessels would become the most irritable and any variation in the general circulation would necessarily first and chiefly affect these cells.

This is a fact of far-reaching consequence. Such ill-nourished, and consequently irritated nerve cells, even though in limited areas, would be responsible for all kinds of motor disturbances, from slight tics to epilepsy; or if in other areas, would be responsible for any mental disturbance from slight depression to acute melancholia. Because a rise or fall in blood pressure does not cause these symptoms in all people, some have concluded that the symptoms have no connection with the circulatory change; but the amount of disturbance is proportionate to the amount of slowing of the circulation and the degree of irritability of the nerve cells involved.

Just as hemorrhage in even a small area of the brain will cause paralysis, so also a local hyperemia, although not severe enough to cause hemorrhage, may cause any degree of mental or motor disturbance. Dilating the vessels of the brain locally may produce almost as much effect on irritable cells in the cortex as dilating all the vessels of the body, because they may produce the same slowing of the local circulation.

After years of suffering and experimentation with prolonged vasomotor disturbances in the head, it has become an obvious fact that in any person where there are abnormally intense

ideas or emotions or motor disturbances, there is some chronic anemia or hyperemia of the whole brain, but greatest where the vascular tone is the poorest in any local area of the cortex.

Whenever one part of the brain is put into moderate use, it not only "diverts the mind," but actually diverts blood into another part of the brain and restores, or helps to restore, the normal circulatory condition.

Most of the results attributed to psychotherapy, mental suggestion, or diversion would be the result of circulatory changes produced in the cortex. No diversion or mental suggestion can have any lasting effect unless it does produce this change in the circulation; because cold, fatigue, or any other purely physical cause will instantly bring back the particular mental disturbance or phobia, if it sufficiently disturbs the local circulation of the cortex. This fact—that physical disturbances can originate, aggravate, or recall the mental disturbances—needs greatly to be emphasized.

It is a tentative theory of the writer, since there can be no intellectual activity without blood being supplied to the cells of the cortex, that the effects of hypnotic and suggestive treatment are produced partly as a result of the relaxed vascular condition of the patient which follows the recumbent position in which the patient is placed. If, then, a different part of the brain is thrown into activity by the suggestion of the operator, the largest possible degree of dilatation of the blood vessels in the exercised area will be produced. This increased amount of blood will inevitably continue the effect of the mental treatment and incidentally diminish the dilatation of blood vessels in the formerly overactive area of the brain.

This would explain the objection of some neurologists to hypnotism, *viz.*, that hypnosis is hysteria and it is therefore a pathological condition, one which may last indefinitely. This objection applies also to some extent to lesser degrees of suggestion.

It is serious enough when a man is in mortal terror of having an attack of cramps or neuralgia or some other physical disturbance, but if he believes that physical ailments are the result

of his ideas and he finds he cannot control his ideas, his condition is logically hopeless; but the premise is wrong.

PART 11

Compensatory Changes in the Circulation

While it may be true, as maintained by Bier and others, that strong irritation of superficial tissues will dilate the internal as well as the external blood vessels, it does not follow that mild counterirritation will do the same. This is proved by the following quotation from "Vasomotor Relations," by W. T. Porter, p. 10:

> It is known that cold applied to one portion of the surface of the body may congest a distant region, while the same stimulus applied elsewhere on the surface will fail to do this. The vasomotor system is rich in association paths, creating a community of interests in certain reflexes. Our knowledge of these associations should be increased by systematic explorations, quantitive where possible.

The human body is developed from two tubes, the anterior (the ventral or body cavity) and the posterior (dorsal or spinal canal).

> In all vertebrate animals, the bodies of the vertebral column form a partition which serves to divide the trunk of the body into two cavities, viz., the dorsal and the ventral.—Brubaker.

Dr. Arnold wrote as follows in his article in the *Medical News,* May 13, 1905:

> We have long recognized the fact that the circulation in the anterior body tube, or the muscles and skin of the trunk, was in a measure compensatory to the circulation of the organs within (developed from) the inner tube; e.g., the application of a mustard plaster over a pleurisy or a congested liver is of service in relieving the congestion. We have never applied the same principles to the circulation in the skin and the muscles of the back as compensatory to the circulation in the spinal cord.

Since the circulation is a "sensitive equilibrium" it does not require violent methods to reestablish or disturb most vasomotor conditions.

Lazarus-Barlow, p. 127, says:

Active congestion is commonly unaccompanied by any change in the mean arterial blood pressure; the reason of this lies in the fact that the area which is the seat of active congestion, is, as a rule, sufficiently small for the compensatory constriction of arterioles in the other parts to take place.

If the spinal muscles are rendered hyperemic by spinal treatment, where else could compensatory changes occur except in the vessels of the spinal cord?

The pressure within a certain area of the arterial system rises or falls according as the blood vessels in neighboring areas undergo constriction or even become impermeable from compression, or ligation, or dilatation. The application of heat or cold to a circumscribed portion of the body, also of pressure or diminution of pressure, and the effect of stimulation or paralysis of certain vasomotor areas, furnish striking proof of the correctness of this statement.

Tissue irrigation is primarily from the heart, but in all extensive systems of this sort, provision is made at the local territories for variation in the supply according to the needs of a part. The sluices are arranged by means of a stop-cock of the arteries, which contract or expand under the influences of the vasomotor ganglia, central and peripheral. If the sluices of one large district are too widely open, so much blood may enter that other important regions have not enough to keep them at work.—Osler, p. 1,197.

Although stimulation of musculomotor nerves along the back or elsewhere does produce immediate muscular contractions which are not the result of vasomotor changes, no continued variation in the functional activity of nerve cells could be maintained without a corresponding variation in their blood supply.

Physiological or clinical proof of the compensatory balance of the circulation is given in the following statements which summarize the daily tests of blood pressure made by the writer before and after each treatment during several years.

In all cases where the blood pressure is below normal from hypotension, unless the patient is extremely weak, the lightest, briefest possible pressure on spinal muscles, or the application of a little alcohol (see RULES) constricts the blood vessels of these muscles, as proved by the fact that the skin blanches, and raises general blood pressure at once in many cases, or gradually in the weaker. Even with extremely weak patients, the

same treatment ultimately raises blood pressure to 120 mm. This proves that such a spinal application diminishes the anemia of the cord, because in cases of low blood pressure the cord and brain are necessarily anemic as a result of the general loss of vascular tone.

Further, if the blood pressure is subnormal and the brain and cord are therefore anemic, steady pressure on the spinal muscles of the splanchnic segments will lower blood pressure still further and increase the irritability of all nerve centers, especially the weakest, and aggravate all existing symptoms. Such manual pressure produces an objective hyperemia of the spinal muscles and at the same time increases the anemia of the cord, as proved by the fall in blood pressure and by the increased irritability of the centers. Similar manual pressure over any particular segment will in any case, by one or more treatments, steadily increase the irritability of the nerve centers in that segment, and it is reasonable to suppose that this local result also is due to the increased anemia of the particular segment.

The manual pressure here referred to is absolutely non-irritating and may be quite agreeable to the patient and yet lower the blood pressure and aggravate the symptoms. (Blood pressure in adults should be 120 and the pulse 72, 66, 60; variations of even a few beats of the heart, or incarcerated gas, may disguise or compensate for arterial variations.)

We know that high blood pressure will result from an increased irritability of the vasoconstrictor centers in the cord. We know that the normal irritability of these centers depends upon the continuance of the normal circulation. The method of treatment employed to lower the blood pressure could produce, primarily, only a dilatation of vessels in the spinal muscles. Such treatment, with a certain class of conditions, lowers blood pressure, very often as much as 25 per cent to 40 per cent. The opposite kind of treatment, which would produce only a constriction of the vessels in the spinal muscles, at once produces a rise in general blood pressure to the same point as before treatment, if desired. These facts would seem

to prove that there is a compensatory balance of blood supply between the spinal cord and the spinal muscles.

In brief, the symptoms of anemia or hyperemia of the brain are well recognized, and by increasing or relieving the anemia or hyperemia by spinal or other treatment these symptoms can be immediately diminished or aggravated. Similarly, by spinal treatment of any segment, obvious variations in the functional activity of the vasomotor, visceromotor, and musculomotor nerve cells in any segment of the spinal cord can be produced, which at once diminish or aggravate symptoms in any part of the body. This would seem to prove that spinal treatment must aggravate or relieve the existing anemia or hyperemia in any spinal segment.

To conclude, the author is confident that if in addition to sufficient food, rest, and exercise anyone will carefully and intelligently maintain a patient's blood pressure and pulse at normal, or as near to normal as possible in the first treatments, with proper treatment of the most affected spinal segments, or in other words, correct any existing anemia or hyperemia of each segment, it will be demonstrated, and frequently in a few minutes, that this is the quickest and most powerful means of reducing the irritability of nerve cells in the spinal cord and brain. And as this irritability and weakness disappear, it will be found not only that all those "serious stomach troubles" which are "without anatomical basis" can be cured, but also that a great variety of other more or less serious troubles in other parts of the body will be cured, including some conditions which are commonly supposed to have an anatomical basis.

The history of any invalid would indicate that this method is not at present extensively employed. But unless a man utilizes the segmental structure of the human organism he cannot expect to produce local vasomotor changes, and until a man has carefully tried this method he cannot say that the writer exaggerates the importance of variations in the rate of the blood flow. A man who has a theory of action which produces uni-

form results must accumulate a mass of facts which are quite unknown to those who are not working in his line and who have, therefore, neither the theory nor the facts.

CHAPTER IV

TREATMENT OF THE SPINE

PART 1

Definitions and Explanations

Definitions

The primary effect on the circulation of all the multiform applications to the spine are only two. This includes all forms of hydropathic, chemical, mechanical, manual, and electrical treatments.

These produce either a local constriction of the blood vessels of the spinal muscles or a local dilatation of these blood vessels by stimulating either the reflex (sensory) vasoconstrictor or dilator nerve endings in the spinal muscles, and, if the stimulation is not too powerful, it produces a compensatory and opposite dilatation or constriction of the blood vessels of the spinal cord.

These two forms of stimulation will be designated as *Momentary Treatment* and *Prolonged Treatment*. The term "momentary" is preferred to "interrupted" or "repeated" because it includes the instantaneous effect of evaporating alcohol or other thermal vasoconstrictors which do not need to be "repeated." The term "stimulation" is properly applied to any spinal application, since "stimulation is any change in the vital conditions." The terms "inhibiting" and "stimulating" are misleading as usually applied to spinal treatments, since either "momentary" or "prolonged" stimulation may be "stimulating" (in the popular sense) or "inhibiting." The effect of any spinal treatment depends on three factors: (1) whether the spinal cord at the time is anemic or hyperemic; (2) the intensity of the stimulus; (3) the degree of irritability of the nerves treated.

As to the first factor: The same spinal application will have

exactly opposite results on the symptoms according to whether the spinal cord is anemic or hyperemic, *i.e.*, if the cord is anemic, Prolonged Treatment will increase the anemia and aggravate the symptoms, immediately or gradually, of any pathological condition whatever. On the other hand, Momentary Treatment will to some extent immediately diminish the anemia of the cord and give the nerve cells of the spinal cord more vitality to overcome or (if tissue changes have begun) to reduce or retard the progress of any pathological condition whatever. Similarly, if the cord is hyperemic, Prolonged Treatment will be beneficial by reducing the hyperemia and Momentary Treatment will be injurious by increasing the hyperemia. This applies to every pathological condition.

As to the second factor—the intensity of the stimulus: If any spinal application is sufficiently painful or even unconsciously irritating to the vasomotor nerves, either Momentary or Prolonged Treatment may produce effects exactly opposite to those intended. Therefore the degree of stimulation must correspond to the degree of irritability of the nerves treated.

As to the third factor—the degree of irritability of the nerves: The results of treatment depend as much on the degree of irritability of the nerve cells involved, whether locally or generally in the spinal cord or brain, as on the intensity of the stimulus employed. In the same individual the difference in degree of irritability between nerve cells in different segments of the cord or in different parts of the brain or between the cells of the cord and those of the brain is almost incredible. Unless the spinal applications are so regulated as to conform to the degree of irritability of the nerve cells involved, no uniformity of results can be expected and all conclusions drawn from any treatment are misleading because one vital condition has been ignored. The degree of irritability of the nerve cells may change extremely during a single treatment. In treating abdominal cramp, at the beginning of the treatment the pressure may need to be incredibly light, otherwise the cramp will be increased. As the cramp begins to relax, harder pressure must be given in order to relieve entirely the existing hyperemia of

the cord. In this connection, the effect of PAIN, discussed in Chapter II, must be carefully considered. Even the irritation produced in a very irritable brain by an unpleasant idea may aggravate any symptom.

To produce the maximum effects in modifying the rate of circulation of the blood through the spinal cord and brain, all applications to the spine should be confined to the muscles innervated by the internal branches of the posterior primary divisions of the spinal nerves, from the first dorsal nerve to the coccygeal nerve. These internal branches supply the muscles for a distance of about three inches each side of the spinous processes.

"Momentary Treatment" means a brief application of some vasoconstrictor to the spinal muscles: either ice, a bottle containing cold water, or a pressure of about one-fourth or one-half pound, applied with the ball of one finger for the fraction of a second, but preferably the evaporation of alcohol. If there is great loss of tone in the blood vessels, the lightest touch of the finger on the spine will aggravate this hypotension—therefore alcohol must be used.

The alcohol may be applied with an atomizer to the spinal muscles two or three inches each side of the vertebræ, immediately blowing so as to evaporate the alcohol quickly. Any rubbing will destroy the effect of the alcohol. Any cold douche will cause vasoconstriction, but if the cold application is too severe or too extensive it will contract all the cutaneous blood vessels and dilate instead of contracting the abdominal blood vessels. If used over any hyperemic spinal segment it will instantly aggravate the symptoms. If one is sensitive it may cause diarrhea, cramps, or a faint, or bring on an epileptic fit with one having epilepsy, or an insane attack in the insane, or similarly aggravate any pathological condition whatever.

The alcohol may be applied by any member of the patient's family, but the effect of the first applications should be carefully observed, because if used at the wrong time or over the wrong segment it may produce the most serious symptoms; but it is indispensable for treating cases of extreme hypotension. The

alcohol should not be applied in a cool room or if the patient is cool, because a general chilling of the surface of the body has exactly the opposite effect from the local application on the spine. If the nerves are very sensitive to the cold, the alcohol must be applied gradually with a piece of cotton.

Never use Momentary Treatment (especially alcohol) over any segment if there is an acute attack of pain or any aggravation of a chronic symptom, because the cord is hyperemic at such times and Momentary Treatment will increase the hyperemia; but cases with *extreme* chronic hypotension will require Momentary Treatment for any acute attack. Almost all kinds of acute attacks with fever require Prolonged Treatment, but extreme hypotension even with a chronic fever requires alcohol. Momentary Treatment should never be given for the sacral segments at the menses. It may be used for the lumbar segments to stop hemorrhage. If hypotension exists Prolonged Treatment is always needed for the sacral segments for menstrual cramps.

Even with low blood pressure from hypotension, if part of the intestines is slightly distended with gas, alcohol may so contract the intestines as to retard, temporarily, the downward movement of the gas, and the retention of gas always disturbs the circulation. The gas should first be diminished in quantity by treating the third to fifth dorsal segments with alcohol; also liberate any incarcerated gas by giving Momentary Treatment with the finger.

"Prolonged Treatment" means a steady pressure, friction, counterirritation, or the application of heat over the spinal muscles innervated from the segment to be affected. The amount of manual treatment required varies from the mere contact of the hand to a pressure of several pounds, according to the irritability of the nerves. The steady pressure of the flat hand is most frequently the most effective method, followed, when possible, by a light rotary movement of the hand or balls of the fingers over the contracted muscle fibers. The clothing and skin should be moved with the hand over the muscles to irritate the nerve endings in the skin as little as possible. For

the same reason never rub long over one spot. Move frequently to other areas, but return persistently until the fibers relax or the pulse and blood pressure have been properly affected. This may require from a few minutes to an hour. Sometimes several hours have been required to relieve a patient in a serious condition. For acute fevers merely hold the hands against the spinal muscles, especially over the most affected areas, until a copious perspiration has begun.

Prolonged Treatment would include any form of counterirritation by heat, chemicals, plasters, electricity, or anything which moderately dilates the blood vessels of the spinal muscles.

A small flatiron (preferably electric), just warm enough to feel most comfortable to the patient, is a very powerful means of giving Prolonged Treatment. It should be moved gently over and parallel to the contracted spinal muscles until they relax. In the lumbar region it must be moved transversely across the muscles. When the spine is too sensitive for manual treatment, the warm spinal compress, or, if heat is irritating, a mild mustard, or capsicum and vaseline application to the spine, is an effective form of Prolonged Treatment for all acute attacks of illness, even for fevers of the infectious diseases.

Patients with high blood pressure or those in Class 3 should be instructed to apply a small hot compress, nightly, if possible, for an hour or half an hour to the most irritable spinal segments. The cloth should be well wrung out, and not so hot as to be uncomfortable. A hot water bottle (preferably metal) covered with a dry towel should be leaned against the compress so as to maintain a continuous steaming of the spine. A few people cannot use heat on any part of the body and more cannot use it on the upper half of the spine without overheating the whole body, producing general perspiration and extra gas formation which may oppress the heart. Otherwise this comfortable steaming of local areas of the spine, even of only the lower half, will help to reduce excessive tension both of the arteries and the alimentary tube and improve the rate of nutrition of the whole nervous system in general and of any spinal segments

in particular. The back should be kept warm for some time afterward.

These patients who regularly require Prolonged Treatment may apply a comfortably warm electric pad or water bottle at least fifteen to thirty minutes every evening in bed to the segments which are responsible for the high blood pressure. If the nerves are very sensitive and if the bag is uncomfortably warm, it may act as an irritant to the nerves and aggravate the internal condition. Some people are exquisitely sensitive to heat and one must depend upon pressure treatment, or the use of some mild counterirritant. Sometimes sleeping with a feather pillow against the spine is the best method. In the same way any irritating pressure of the hand may instantly raise the blood pressure or weaken the heart action. Sometimes any pressure of the hand is too irritating, and one must, at the beginning, depend entirely on the warmth of the hand or the bag to do the work gradually. During any acute attack the bag may be used as long at one time as desired. If the trouble is in a few segments only, as often from the fifth to the ninth dorsal segments, or in one or two sacral segments, a Japanese hand-warmer will produce a more local effect than the warm bag.

As the spine becomes less sensitive, a patient can give himself daily treatment. In hot weather, when the warm bag would be uncomfortable, mild counterirritation, as with capsicum vaseline, or proper pressure or rubbing, is more effective than heat. In hot weather, when it would be impossible to use a hot water bag, the same and even more powerful results may be produced, if the nerves are not too sensitive, by rolling up a strip of flannel four or five inches wide into a cylinder one or two inches in diameter and lying on the roll so that it will press against any desired segment or half segment. A flesh brush may be used once or twice daily on the spine by a patient. These applications are for those in Classes 3 and 4 of Chronic Conditions.

For acute attacks treatment may be continued until relief is produced, but one should be extremely careful not to increase the irritability of the nerves involved by too hard or too prolonged pressure. When spinal muscles contract, they

may draw the vertebræ out of normal alignment, but the trouble is not in the muscles, or the bones, or the ligaments, but in the nerve cells whose excessive irritability causes the muscles to contract. Correcting the circulatory disturbance in the cord reduces this irritability and relaxes the muscles. Prolonged Treatment must not be given so hard as to cause perspiration. The vasodilatation should be confined to the spinal muscles. If a general vasodilatation is produced it makes more gas and dilates the cerebral vessels. For fevers, the perspiration is beneficial and necessary to relieve internal congestions.

The range of results which may be obtained by manual treatment of the spine is as wide as the results obtained by different players on the piano. If the pressure is too hard, the nerves are irritated and little or nothing is accomplished; if too light, nothing may be accomplished. The object to be obtained in giving Prolonged Treatment, is *the maximum dilatation* of the blood vessels, with the *minimum irritation* of the nerves.

For all acute illnesses, including all infectious diseases, the hot spinal compress is the most powerful means of controlling congestions and reducing the fever. The first compress should not be as hot as those following. None should be irritatingly hot. A dry blanket should be put over the hot, wet blanket. Hot water bottles should be placed against the dry blanket, to maintain a continuous steaming of the spine. The water should be wrung as far as possible from each compress so as to keep the bed as dry as possible. The second compress should be applied after about fifteen minutes; subsequent ones at longer and longer intervals. Moist heat is not as irritating as dry. After profuse perspiration has started, keep the patient warm enough to maintain a slight perspiration until all fever has gone. Holding the warm hand over the most congested parts of the cord greatly increases the effect of the general compress.

"Vasomotor" and "arteriomotor" are terms applied to those nerve cells in the spinal cord and brain which control the caliber of the arteries and arterioles, and to the nerve fibers which connect them with the muscle fibers in the walls of the arteries. There are two kinds of vasomotor nerves, the vasoconstrictor,

which contract, and the vasodilator, which dilate the arteries and arterioles, thereby regulating the quantity of blood going to every part of the body.

"Visceromotor" (viscero-inhibiting or -accelerating) nerves are those which contract or relax the involuntary muscle fibers of the viscera, as the stomach, intestines, or the iris of the eye.

"Sympathetic" and "ganglionic" are terms used to include all the vasomotor, visceromotor, and pilomotor nerves (those which when stimulated produce "goose flesh").

While anatomically the sympathetic system is largely outside the spinal cord, still the controlling nerve cells are in the spinal cord and are affected by spinal applications as other nerve cells. Just as the vasomotor nerves maintain a certain normal tone and caliber of the arterial tube, so the visceromotor nerves maintain a normal tone and caliber of the alimentary tube. If

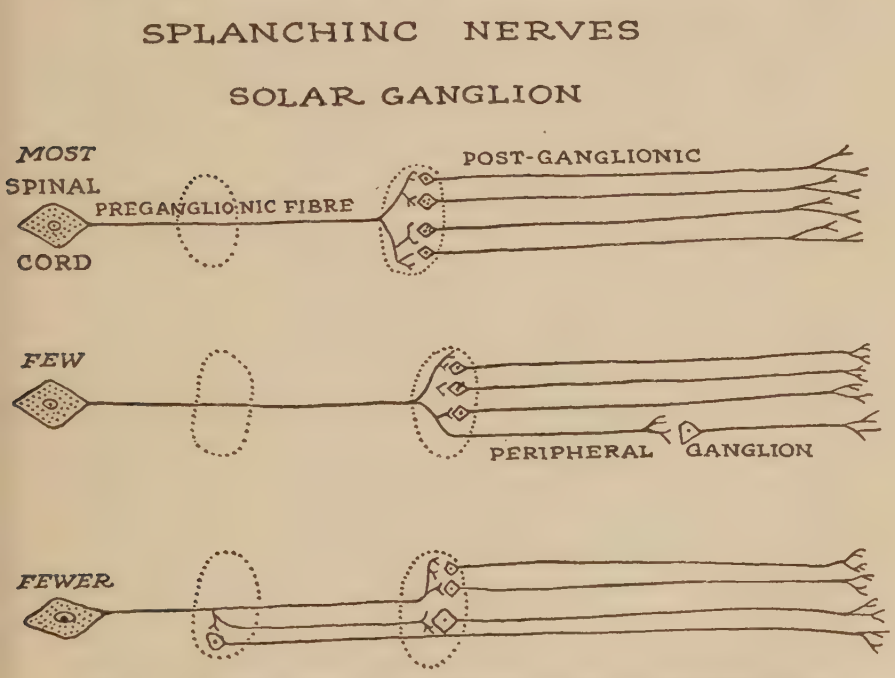


Diagram to illustrate how one controlling cell in the cord multiplies its area of control by its contact with subordinate cells in the ganglia of the sympathetic system.

the arterial tube constricts or dilates, then the recoil of the arteries and arterioles fails to propel the blood at the normal rate. Similarly, if the alimentary tube relaxes or contracts, then the peristaltic wave fails to propel the contents of the intestine or bowel at the normal rate.

A ganglion is a kind of switchboard arrangement where one cell in the spinal cord is connected with several other motor cells, thereby having its power multiplied. (See diagram, p. 111.) Even when separated from the spinal cord the ganglion cells by their independent action can maintain a limited contraction of the arteries.

The term "hypotension" is used to designate that condition of the circulation where there is a loss of tone in the blood vessels, especially the abdominal. The low tension is often disguised and the blood pressure may be as high as 180 mm., as the result of gas held in the stomach or bowel. The gas either increases the intra-abdominal pressure or accelerates the rate or increases the force of the heart beat. As soon as the gas moves the pressure will drop to 120 mm. The most serious cases of low tension may have apparently, therefore, a high blood pressure, but the pulse should never be more than 72 and should in many people be only 66 or 60, and regular and full.

With hypotension there is always a tendency for some or all of the abdominal blood vessels to dilate excessively from a small amount of fatigue, excitement, cold, or a slight spinal pressure. When this passive dilatation occurs, the brain and spinal cord become anemic, even though in some cases the blood pressure remains normal, or above, in the arm; because hypotension of only part of the large abdominal arteries is sufficient to diminish the rate of the general circulation. The heart action also becomes weaker when the abdominal vessels dilate, and this still more reduces the rate of blood flow and aggravates all the symptoms of anemia of the brain and cord. This fact can be demonstrated in a few minutes on these cases by noticing the pulse before and after giving Prolonged Treatment for the splanchnic segments. Lauder-Brunton has shown that the

arteries, as distinct from the heart, maintain the circulation for thirteen hours out of every twenty-four.

As the pulse wave reaches each part of an artery the recoil-contraction of the muscle wall, controlled by the vasoconstrictor nerves, propels the blood rapidly onward. Consequently, if there is any loss of constrictor tone in any part of any vascular area the rate of the blood flow is less than normal. This fact and the following quotation explain the poor nutrition which results from a period of hypotension.

> Every beat of the arteries, tends also to help on the venous blood, for the arteries and veins usually have a common sheath of unyielding fibrous tissue, and each time that an artery is distended during a ventricular systole, it tends to push a corresponding amount onwards through its accompanying vein.—Lauder-Brunton, p. 6.

"Hypertension" is used in those cases where there is a tendency for the already constricted abdominal vessels to become still more constricted when the patient is subjected to some stimulus as fatigue, cold, excitement, or has eaten indigestible food. The blood pressure is of course above normal (120 mm.) unless the heart has begun to weaken as a result of working against the hypertension; this sometimes serious condition (called "secondary low tension") must be treated as a case of high blood pressure even though the blood pressure is normal or below.

The circulation may be disturbed to any degree, even though the vasomotor nerve cells are normal, by excessive irritability of the visceromotor nerves which control the contractions of the gastric or intestinal muscles. The resulting retention of gas disturbs the pulse or blood pressure and aggravates any symptoms whatever. This condition is called Class IV in the Summary and requires Prolonged Treatment although the blood pressure may be above or below normal, depending on the force of the heart beat.

Explanations

In giving treatment it should be remembered that the vasoconstrictors respond first, but if the stimulation is continued, the dilators overcome the action of the constrictors.

The constrictors respond best to momentary or rapidly repeated brief stimulation; the dilators to continued stimulation. "Vasodilators are more readily exhausted than vasoconstrictors." Landois, p. 772. Prolonged stimulation produces first brief constriction, followed in a few seconds by an active dilatation which may continue for a considerable time.

The lumen of the vessel can be influenced directly by local applications; cold and moderately weak electrical stimulation causing contraction, and, conversely, heat and strong electrical or mechanical stimulation causing dilatation, the latter two probably after transitory preceding contraction.—Landois.

The "transitory preceding contraction" explains why a cough or other symptom may be momentarily started or increased by the first contact of the fingers when beginning to give Prolonged Treatment for an acute attack. According to Neiswanger, in "Electrotherapeutical Practice," p. 10, "A galvanic current at the positive pole acts as a powerful vasoconstrictor; the negative pole acts as just as powerful a vasodilator." This explains how electrical applications may produce some of the same results as manual treatment, if intelligently used.

The growth, nutrition, secretion, and muscular contraction of all of the tissues of the body are controlled by cell bodies (neural units) in the spinal cord. The activity of these cells depends upon their blood supply.

Whatever increases, within physiological limits, the rate of flow of the blood going to the spinal cord, increases the activity of whatever nerve centers are then active; including, of course, those which regulate the caliber of the arteries and the contractions of the stomach and intestines. The vasodilator and viscero-accelerating nerve centers respond less quickly to increased blood supply than the vasoconstrictor and viscero-inhibiting centers, but are more powerful when active and for the time being completely overcome the action of the vasoconstrictors.

When the vasodilators cease to act, either from exhaustion (this may be after several weeks, as in typhoid), or from cessation of stimulation, the vasoconstrictors resume their normal

activity if the congestion of the cord has not been too severe. Until the crisis of a disease is reached the vasodilators are active; during the "lysis" the vasoconstrictors may be weak.

Vascular changes in the spinal cord are constantly recurring and like those in the brain, are relatively far more important than those which occur in any other part of the body, because the vascular changes in the cord and brain are the cause or necessary accompaniment of all vascular changes in other parts of the body. There can be no active dilatation of the blood vessels in any organ without a corresponding vasomotor change in the segments of the cord or brain which contain the controlling vasodilators, because increased cell activity demands a greater blood supply. Even when congestion follows local infection or injury, there must be a corresponding vascular change in the cord.

The vasoconstrictor cells are active night and day in order to maintain a partial constriction (arterial tone) of the blood vessels. These cells send a steady stream of messages to contract the muscles in the coats of the blood vessels. The vasodilators are only active when an organ or muscle is active, or during acute pathological conditions.

The muscular movements of the internal organs are accelerated and inhibited by neural units in the spinal cord, called viscero-accelerating and viscero-inhibiting centers.

The vaso (or arterio) dilator neural units and the viscero-accelerating neural units are situated together chiefly in the brain and sacral segments of the cord and act simultaneously.

The vasoconstrictor and viscero-inhibiting neural units are also located together and act simultaneously.—Arnold.

Therefore treatment may affect simultaneously whatever vasomotor and visceromotor nervous mechanisms are then active. Whichever kind of nerves is the weaker will be first affected by treatment.

The vasoconstrictor cells are all between the first dorsal and fifth lumbar segments.

The vasoconstrictor and dilator neural units for the cervical cord and brain are in the second and fourth dorsal segments.—Arnold.

Those vasomotor nerves which supply the blood vessels of

the muscles follow the distribution of the musculomotor nerves, and those supplying the blood vessels of the skin follow the paths of distribution of the sensory nerves.

It is to be borne in mind that both dilator and constrictor fibers may run side by side in the same anatomical nerve; e.g., the sciatic.—Butler.

Continuous pressure on the trunk of a nerve (as of the occipitals) diminishes its conductivity; therefore when a patient has an occipital headache, because for some reason the vasodilator or musculomotor nerves are overactive, this steady pressure diminishes the conductivity of the nerves and thereby diminishes the congestion or muscular contraction. Such steady pressure alone may sometimes relieve the most intense pain, as in the sphincter and by pressure on the nerve trunk each side of the rectum, applied by the patient.

Cold, as produced by the rapid evaporation of alcohol, is more powerful than the Momentary Treatment with the finger, but heat is not so powerful as manual pressure in giving Prolonged Treatment. The foregoing facts and the laws of nervous irritability in Chapter II, will explain the different effects produced on different people and the resulting successes and failures of the many therapeutic applications to the spine which are used everywhere, *e.g.*, all the hot and cold applications used in hydropathic sanitaria, electrical spinal treatment, vibrators, spinal brushes, plasters, cautery, acupuncture, and other forms of counterirritation.

Severe illness of any kind, as fevers, or prolonged peripheral irritation of any nerve, as from injury or operation, produces, for the time being, active hyperemia of the cord. If the irritation is long continued, this active hyperemia is followed by a more or less prolonged passive hyperemia with a consequent weakness and irritability of all the nerve centers in that part of the cord. If the general blood pressure is low, the spinal cord will be anemic and especially in the segments where there is the greatest loss of vasoconstrictor tone.

Just as the chief vasomotor center in the medulla is dependent on its own activity to maintain its own blood supply, so

there are vasoconstrictor nerve cells in the dorsal and lumbar spinal segments which are dependent for their normal blood supply, to a certain extent, on their own activity. Just as in a faint, the vital circle is broken and only mechanical interference (lowering the head to bring back the blood) can restore the vital circle, so also acute or chronic hyperemia or anemia of the cord may so weaken or irritate the vasoconstrictor centers that a vicious circle is established. Spinal treatment will at once powerfully aid in restoring the normal circle, causing some immediate improvement in most acute conditions and gradually curing all chronic conditions due to weakness of nerve cells. As in a faint, so in many other conditions, medical or psychic treatment is insignificant compared with the accuracy and efficacy of restoring the spinal blood supply.

The degree of soreness or contraction of the spinal muscles innervated from the same segment as the affected organ, is usually an exact test of the location and amount of the internal disturbance.

The rapidity with which this soreness diminishes or disappears during a treatment is an exact test of the degree of nervous irritability, or of the amount of vascular disturbance from cold or other causes.

During many acute attacks when there has been a marked hypertension of the vessels of the spinal muscles, there may be no sensitiveness of the back at the beginning of the treatment; later the back becomes very sensitive and finally this extra sensitiveness will disappear with the symptoms for which the patient is being treated.

Although authorities agree that there are no vasoconstrictor nerve cells in the sacral segments, still, if one has marked hypotension, Prolonged Treatment for these segments will immediately increase the loss of tone in the blood vessels of the legs and in the pelvic bowels and blood vessels, with aggravation of the local and perhaps general symptoms. Prolonged Treatment for one-half of one sacral segment has lowered the blood pressure 40 mm., and caused severe cramp of leg muscles. Momentary Treatment applied to the sacral segments only, instantly

contracts the pelvic blood vessels and bowels. Therefore the same nervous control exists in the sacral region as in the other parts of the spine.

Whenever a chronic relaxation of the blood vessels occurs in any part of the body, the normal physiological hyperemia which should occur during the functional activity of the parts becomes excessive because the vasoconstrictors are weak. Thus, if there is a lack of tone in the blood vessels of the head, the excessive dilatation of the vessels which occurs when the patient tries to study may cause headache.

In examining the spine, in addition to any other diagnostic tests, place the patient on his side with the body and legs perfectly straight and hand resting on the hip. The patient should lean slightly away from the operator. This relaxes as much as possible the muscles of the upper side of the spine. There should be no tenderness or contraction of bundles of muscle fibers; when contracted, these bundles roll under the palpating finger and vary in size from that of the diameter of a knitting needle to the thickness of the thumb. The same may be found along the right side of the vertebral column when the patient is placed on the left side. Prolonged Treatment should be applied to the most tightly contracted muscle fibers, especially close to the vertebræ. Usually, the greater the contraction the more sensitive is the muscle. Between the scapulæ, to control the blood supply to the head and stomach, it may be necessary to treat contracted fibers even as far from the vertebræ as out to the inner margin of the scapulæ. Sometimes treating a tightly contracted muscle bundle no bigger than the end of a finger will stop the formation of enormous quantities of gas or, lower down the spine, relax a painful intestinal cramp. After treating the spinal muscles on one side, the patient should then turn on the other side and the upper side be treated similarly. But if the heart is weak or there is much gas in the stomach it may be unwise for one to lie on the left side.

In treating or in examining, use the ball and not the end of the finger. (The examination can be made and the treatment given through two or three layers of clothing.)

When examining the neck, the patient should lie on the back without any pillow, so as to relax the cervical muscles as much as possible. The muscles should be perfectly elastic, smooth, and painless to moderate pressure. An examination of the spinal, cervical, and abdominal muscles in connection with the pulse and blood pressure tests, will always determine which are the weakest spinal segments in a man's nervous system, and these will be the first to give out from fatigue, cold, or excitement.

Such an examination will decide which segments most need treatment and what kind, and it will also decide to some extent the location and severity of the disturbance, and will aid in deciding whether a symptom is primary or reflex. These tests will indicate whether treatment has had a proper effect.

In palpating abdominal muscles to determine the degree of contraction, be sure to use the ball of the finger and begin pressure very gently and gradually. The intestines will be contracted and transmit the throbbing of the arteries wherever there is an excessive irritability of the controlling segments of the cord. After each treatment, the intestines should relax or contract toward normal. The chronic symptoms for which a patient is being treated usually disappear before the contractions of the spinal muscles entirely subside. The muscular contractions continue to relax even after treatment has ceased, because the better circulation gradually reduces the irritability of the controlling musculomotor nerve cells.

With any acute attack it will be noted that, among the spinal muscles controlled by those spinal segments which must be treated, certain muscle bundles or strands stand out more prominently than any others; pressure should be applied primarily and chiefly to these prominent bundles. Spinal muscles may become very relaxed in certain stages of starvation of the cord and may not be sensitive. In such people only motor nerve cells are excessively irritable, in others only the sensory.

In case of a gradual death of the cells of the cord, as in scleroses, the sensitiveness may be on the better side of the spine, because from the progress of the disease, the sensitive-

ness has died out on the worse side. Spinal muscles, especially in the old, also become contracted from long continued faulty positions. Soreness is then the only diagnostic sign. In both acute and chronic troubles the sensitive areas may be over the dilators or the constrictors or both. Ticklishness is hypersensitiveness, and if increased, becomes pain. The skin over the spinous processes is often exquisitely sensitive, because cutaneous nerves from both sides meet here, but it is not necessary to press on the vertebræ during treatment.

If a patient is having alcohol applied two to four times a day, unless special symptoms arise, it is usually not necessary to give a treatment and test the circulation oftener than once or twice a week, because time must be given for gradual building up of nerve cells. If the circulation is very unstable a patient needs to be treated every day, especially if the brain is in a critical condition, until the normal circulation is fairly well established. As soon as the circulation is stable, the effect of treatment continues without additional treatment, because the nervous system is receiving a normal income of nutrition, provided the patient is also eating and sleeping sufficiently.

An acute condition may need to be treated two or three times a day. With many patients who were able to be at work, it has been possible to cure them by only one treatment a week, provided they could apply the alcohol or heat or pressure every day over the proper segments. Intelligent patients can be taught gradually how to treat many of their changing conditions.

Many persons using spinal treatment employ so much force as to tremendously accelerate the whole circulation and make the patient feel stimulated and exhilarated, and any acceleration of the circulation will benefit many patients; but this effect is not necessarily beneficial, is often temporary, and may be dangerous in cases of high or low blood pressure, though it makes a great and favorable impression mentally, on some patients. To produce permanent results, the normal vascular condition in each half segment must be restored and maintained, and this result should be produced accurately.

In giving a number of treatments for any condition it must be constantly remembered that every variation in activity of any cell bodies in the central nervous system or peripheral tissue is dependent upon variations in the blood supply to those cells. Therefore, to combat any symptom, one must observe what is the cause of the vascular disturbance, and what spinal segments are involved. Cold, fatigue, indigestion, infection, excitement, injuries, and the menses produce these vascular fluctuations. One should try to bring the patient's pulse and blood pressure as near as possible to normal by each treatment. Most variations of the pulse or of the blood pressure are the immediate result of abdominal disturbances, even when excited by purely mental causes.

The acute vascular disturbances produced by rheumatic fever, grippe, dysentery, typhoid, malaria, pneumonia, and some other infections can be immediately and very favorably affected in spite of the presence of the infections. The infection must, however, run a course, though the duration and severity of the symptoms will be lessened by treatment, each treatment making noticeable improvement in symptoms. If the whole spine is sore, when a patient has diarrhea or lumbago, it proves that cold is the cause of the disturbance. Catarrhal symptoms sometimes begin to appear during treatment, in the nose or bronchial tubes, as the diarrhea or the lumbago is relieved; this is another proof that cold has affected all the spinal segments and is the cause of all the symptoms. As long as nerve cells in the central nervous system are weak, they will be affected by any slight vasomotor change; as they become stronger they are less and less disturbed by such fluctuations; for example, those who are mentally depressed or have any irritable musculomotor nerve centers will have mental or muscular symptoms, with every slight attack of flatulence, because the flatulence disturbs the blood supply to the weak centers. But when the nerve cells in the brain and spinal cord become strong, even considerable flatulence will not produce any of the former symptoms. Before treatment, the nerve cells are like those in infants and the least variation in their blood supply from cold, excitement, fatigue, or indigestion

disturbs them. When vigorous health is established the nerve cells have lost this excessive sensitiveness. Many people become discouraged if they have a temporary return of symptoms which had begun to disappear, but anyone, especially one who has had a great loss of vasomotor tone for years, is likely to have some vascular fluctuations produced by cold, indigestion, fatigue, or excitement. These attacks may be as severe as any they had before they began treatment. This must be expected, except with very careful patients; but as soon as the circulation is again reestablished it will be found that none of the improvement has been lost.

It is absolutely necessary before giving each treatment to those in Class 1 or 2 (see Summary, p. 143) to know whether a chronic condition has been aggravated even in the slightest degree by cold; if so, it may be necessary to give a treatment of the affected segments exactly opposite to the treatment usually required. Giving the wrong treatment would immediately aggravate or start anew any acute attack, as for example neuralgia, headache, or diarrhea. If a patient has had some long-standing chronic trouble, and he is proud of the fact that he "never takes cold," it is possible that the chronic trouble is largely the result of his pride, because there is always a loss of vasomotor tone in the affected area, and this area will be excessively affected by all the fluctuations in blood supply from exposure to cold to which such a man subjects himself.

If there is any local trouble in any part of the body, as congestion of the eye or swelling of the ankle, as a result of a weakness of the nerve cells in a particular spinal segment, the result of some prolonged disturbance of the blood supply in this segment, following cold, a blow on the back, or some severe illness, local treatment of any kind, by anybody, of any tissue or organ innervated from this segment, becomes futile just in proportion to the amount of vascular disturbance in the cord. Similarly, in acute conditions, the recovery of any local area in the body depends on the amount of general vascular disturbance. Only exact segmental treatment can determine how often and to what extent in any condition vascular changes in the cord are

the cause of the peripheral symptoms. Even conditions due to injury or infection will be relieved only if, in addition to local treatment, the normal vasomotor tone can be restored, either gradually, without treatment, if the injury is slight or the vitality great, or more rapidly by mechanically reestablishing the normal vascular equilibrium in the spinal cord.

Cold affecting particular segments may cause any form of indigestion, sometimes causing cramps of gastric or intestinal muscles; or it may aggravate constipation by disturbing the blood supply to the already too weak nerve centers controlling the bowels.

Cold may cause diarrhea or produce any degree of hyperemia of the mucous membrane even to the point of causing abscesses or ulcers in the gums or any other mucous membrane. This hyperemia or congestion may be laryngitis, pharyngitis, gastritis, colitis, appendicitis, or hemorrhoids. An "itis" not directly due to injury or direct infection is the result of weakened action of the controlling vasoconstrictor nerves or excessive vasodilatation. Infection may or may not follow the congestion. Cold may cause jaundice by congesting the mucous membrane of the gall duct, thereby closing the duct. Cold may cause hyperacidity of the stomach or any amount of flatulence by increasing the amount of blood going to the stomach. Cold may, and usually does, cause neuritis, especially if one is fatigued. Cold may affect the blood supply and therefore the activity of the musculomotor nerve centers, producing contraction of the voluntary muscles, resulting in stiff neck, lumbago, etc.; if it disturbs the vasomotor nerve centers for any tissues that are affected, swelling may result. This muscular contraction and swelling commonly occur together, though one symptom usually predominates. It is usually called rheumatism, but whatever name be preferred, just so long as people think rheumatism is due to the condition of the blood or think that all indigestion is due to food, just so long will they neglect to protect themselves from those changes of temperature which will cause rheumatism, indigestion, or almost anything else even in previously well people. The presence of uric acid in the blood

is an additional factor, but no more the cause of rheumatism than snow is the cause of winter. The amount of disturbance from cold depends on the suddenness and severity of the change in temperature, the condition of the skin as to perspiration, but chiefly on the fatigue, weakness, and therefore irritability of the nerve centers. (See Chapter and Warning on Cold.)

There is no question about the value of fresh air, but weak and irritable vasomotor mechanisms must be protected from sudden changes in temperature. No tissue can have any opportunity to recover unless the general and local circulatory conditions are sufficiently favorable, and any chronic trouble, whether melancholia, Bright's disease, neuritis, or tuberculosis, may be aggravated by cold.

By careful tests and observations it will appear to be an absolute law that whatever depresses the circulation, increases nervous irritability. Hence the prescription of exercise, baths, food, and treatment should depend on their effects on the circulation. Nothing can be in any way beneficial to the nervous system unless it in some way contributes toward restoring the normal rapid rate of circulation or quality of the blood flowing through the brain and spinal cord.

If one goes from a cool to a warm room, it is easy to observe how quickly the superficial veins on the hands dilate. If one is tired or weak, this distension of the veins is greater because the vasomotor nerves which control the blood supply to the hands are also tired or weak. Gravitation also will increase this distension just in proportion as one is tired or weak. Similarly, in other parts of the body the same causes produce similar, if less noticeable, fluctuations. If there is any pathological condition in any tissue, there is a weakness or disturbance of function of the nerve centers controlling the blood supply to that tissue; therefore, on account of this weakness the slightest change of temperature, or the least overfatigue, may be sufficient to produce an excessive fluctuation of blood supply to that tissue.

This is just as true of the blood vessels of the spinal cord or

brain; hence, any condition, including those called neuroses, is aggravated by fatigue or cold.

Such a condition as catarrhal deafness may be the result of a long succession of additions to an originally, perhaps, slight disturbance of circulation.

In treating any local trouble, all the laws and considerations in regard to blood pressure, pulse, cold, indigestion, and fatigue must be borne in mind in giving each treatment. No one can decide what a patient's normal pulse is until *after* one or a few treatments. In all adults treated, both men and women, it has finally stayed at 72, 66, or 60. Anyone may live for years with a disturbed pulse, but sooner or later there will result irritability of some part of the nervous system, as a result of the diminished rate of nutrition. Even if the pulse is apparently normal, abdominal soreness always indicates some degree of resistance to the rate of flow of the blood.

The vasomotor nerves must recover at least some of their normal tone before other weak nerve cells can recover; therefore the attention of the physician should be directed primarily to the condition of the circulation as indicated by the pulse, blood pressure, and the condition of the abdomen.

If one watches other symptoms and ignores the condition of the circulation in each spinal segment, and in the brain, all treatment is experimental, for if the circulation is disturbed, even to a slight degree, part or all of the nervous system becomes, more or less rapidly, starved out and therefore increasingly irritable; conversely, no weak nerves can recover unless in some way the normal circulation to that part of the spinal cord or brain is restored. This is not less important when the circulation is tremendously disturbed by some general infection.

The effects and treatment of conditions resulting from traumatism, some infections, neoplasms, and advanced tissue changes are only alluded to, but even in such conditions where local and antiseptic treatment is necessary any recovery of the tissue depends on the vigor of the local and general circulation. If the general circulation is seriously depressed, it is impossible

for any local area to recover, no matter what kind of local treatment is used.

The facts of etiology and pathology emphasized are those which tend to show to what extent the spinal cord controls the functional activity, growth, secretion, nutrition, and therefore the recovery of every tissue in the body. Just in proportion as one has the opportunity to observe to what extent the activity of the cerebral and spinal nerve cells is controllable by spinal treatment, will one begin to realize how valuable an adjunct to all surgical, antiseptic, or antitoxin treatment would be the knowledge of how to restore to normal, or as nearly to normal as possible, the activity of the nerve centers controlling the blood supply or muscular contraction of any tissue under treatment.

Frequently this vital consideration is absolutely ignored in treating many conditions; and in all routine methods of affecting the blood supply, unless one carefully watches the blood pressure, pulse, and other factors and considers each spinal segment separately, it is purely accidental whether the strength of particular centers is increased or decreased. It is important to form the habit of regarding the body as a social cell community, all the members of which are under the control of the most highly specialized cells in the brain and spinal cord. Also to bear in mind that the health and functional activity of each cell depend absolutely upon its blood supply. From the standpoint of cell physiology, there may be no difference between melancholia and lumbago.

Pathology is coextensive with the question of nutrition. Every pathological condition is fundamentally a nutritive one.—Lazarus-Barlow.

Palpation of the spinal muscles and abdomen will determine the location and severity of a disturbance in any part of the body; but the diagnostic directions under "Rules" are not a substitute for other methods of diagnosis, but are additional and invaluable. Unless the nerve cells are dead or the change of peripheral tissue too great, improvement will inevitably follow the treatment, if the patient is living a reasonably hygienic life.

It should be remembered that any long continued congestion may build up connective tissue which by its contraction destroys the original tissue.

The cells of all tissues go through recognized stages of degeneration and the amount of improvement which can be produced by controlling the blood supply depends obviously on the stage of degeneration reached. We know that phagocytes can remove bone-callous, and the improvement of circulation produced by treatment will explain how abdominal adhesions have been cured by this treatment. Even in cases of optic atrophy treatment has accomplished what the oculist said was impossible—made a marked improvement—and even in locomotor ataxia, or any disease where there is a progressive destruction of nerve cells, the treatment will arrest the progress of the disease and make a limited improvement by reviving the dying cells.

In the following pages the author has enumerated only conditions which he has known to be relieved or cured by treatment. Recovery will be retarded, however, just in proportion as the circulation is kept disturbed by the excessive use of tobacco, alcohol, drugs, and perhaps even tea and coffee, which are irritants or depressants to weak cells, and especially to vasomotor cells, or if a patient is persistently overworking, which means living beyond his daily income of physical strength. Fatigue, even from too much talking, can aggravate any trouble, from nervous prostration to muscular rheumatism. All the vital factors must be considered. No mention is made of the numerous conditions which are the results of syphilitic or similar infections requiring the use of antidotes; but it would not be a disadvantage to any sick man if something were done to reestablish the normal nutrition of the affected tissues.

The results to be expected from treatment are limited not only by the extent of tissue changes, but by the degree of irritability which the nerve cells have acquired. If the blood pressure has been very high for years, on account of extreme irritability of the vasomotor nerves, the rate of recovery is not only slow but exposure to the slightest cold or fatigue adds at once

to the already existing vascular disturbance in the cord and to the extreme irritability of all nerves, especially the weakest. Therefore, in extreme cases little can be accomplished without the intelligent cooperation of the patient. Just in proportion as the patient has adopted some extreme theory in regard to diet, either starvation or stuffing, or if the patient is addicted to "cold plunges" or to some ill-considered attempt to get "fresh air" regardless of the effect on the most sensitive nerve cells, the attempt to reduce the nervous irritability by maintaining the necessary uniform circulation becomes difficult or impossible. The situation is not less difficult if the patient has accepted the theories that his symptoms are the result of "uric acid" or "auto-intoxication" from poisons absorbed from the digestive tract and is therefore afraid of food.

PART 2

Blood Pressure

To save space, the writer would recommend any good book on blood pressure, but the following facts in regard to the heart, pulse, blood pressure, and vasomotor nerves should qualify some statements in the literature on blood pressure.

By blood pressure is meant the pressure exerted by the blood on the walls of the vessel in which it is flowing.

Maximal (systolic) pressure represents heart energy. The minimal (diastolic) pressure represents the peripheral resistance (vasomotor changes), while the pulse pressure (the difference between the maximal and the minimal pressures) represents the head of pressure in the arteries tending to drive the blood onward in the peripheral arteries.

Since minimal pressure represents the pressure supported by the whole arterial system during the diastole of the heart, a determination of this reading indicates the immediate resistance which must be overcome by the pumping action of the heart.

Pulse pressure indicates the extent to which this resistance is overcome.

Maximal pressure indicates the total amount of energy expended by the heart in performing its work.

The booklets which come with blood pressure apparatus, as the "Tycos" from which the foregoing condensed statements are

taken, explain the methods of testing blood pressure. To avoid causing unnecessary discomfort or pain which may disturb the blood pressure and destroy the value of the test, the writer has made the blood pressure test as quickly as possible. For the same reason it is not necessary when the blood pressure is considerably above normal to make perfectly exact tests. The same treatment will be required whether the blood pressure is 180 or 250. It is only when the blood pressure is about normal that even a change of 3 or 4 mm. may indicate which kind or how much treatment to give. Unless specified, "blood pressure" will mean the systolic. The presence of incarcerated gas causes remarkable variations in the blood pressure. One may have great hypotension and yet have a blood pressure of 180 mm. One may also have hypertension with a blood pressure of 180 entirely due to gas; because in each case the blood pressure has come to 120 immediately after the gas was liberated by treatment. Consequently any blood pressure test may be of little value unless it is determined whether it is due to the degree of irritability of the vasoconstrictor nerve cells or to the pressure of incarcerated gas. Arteriosclerosis may follow hypertension, but hypertension of arterial muscles is the result of excessive irritability of the vasoconstrictor nerve cells which control the contraction of those muscles. Causing the patient pain by a prolonged compression of the arm is an endurance test, not a blood pressure test.

For all practical purposes in giving treatment it is necessary to test the blood pressure at one point only, the arm, by the auscultatory method, provided that any constant deviation from normal in the blood pressure or in the rate or character of the pulse is considered detrimental if not pathological. If a man's normal pulse is 60, a persistent variation from normal, even of two beats when at rest, indicates a disturbance of the circulation.

The blood pressure test may be very misleading unless made before and after treatment of the separate vascular areas of the body, because there may be anemia of certain segments, as of the lower dorsal segments, producing low blood pressure from

hypotension, and at the same time there may be a hyperemia of the sacral segments, which control the contraction of the lower intestines. This hyperemia of the sacral segments produces an excessive contraction of some parts of the bowels in the lower half of the abdomen, and the consequent retention of gas adds to the low blood pressure. In such a condition, Prolonged Treatment for the lower dorsal segments would lower the blood pressure as would also Momentary Treatment for the sacral, whereas Momentary Treatment for the lower dorsal or Prolonged Treatment for the sacral segments, or both, would raise the blood pressure.

Variations in the vascular tone, even in small abdominal areas, produce variations in the blood pressure, or of the pulse in the arm, or in the pulse, and the rate of flow of the blood in the brain and spinal cord cannot be normal if there is the slightest disturbance in the blood pressure in the arm or in the number or nature of the pulse waves.

To be certain that each treatment is beneficial, it is necessary to observe both blood pressures, the number and force of the pulse waves, the tension of the abdominal, gastric, intestinal, and cervical muscles, and sometimes of the heart sounds, both before and after treatment; and to regard carefully all subjective symptoms. And in making a diagnosis these tests may be necessary both before and after treatment of any particular segments in order to determine which segments are responsible for the disturbance of the pulse or the blood pressure, or other symptoms. In this way each treatment is a demonstration that the rate of blood flow is better immediately after treatment, as proved by improvement in pulse, blood pressure, or both, and by the reduced irritability of nerve cells, which is proved by the reduced tension or pain in the muscles tested. As stated in Chapter II, it is a most remarkable and instructive fact that the systolic pressure has sooner or later come to 120 or 121 mm., and the diastolic pressure to 80 mm. in all adults, both men and women, even those seventy years old, when discharged as cured. It is no more incredible than that the temperature should always be ninety-eight and two- or three-fifths. Leonard Hill says:

"Some robust old men have pressures no higher than those of the young." A well man will feel weak if the blood pressure falls to 80 mm.; he may keep apparently well for some time with a blood pressure of 100, but gradually, sometimes not until after several years, an excessive irritability of part or all of the nervous system will inevitably develop if the rate of the circulation of the blood is below normal. A small pulse pressure always means a depressed rate of the circulation.

Blood pressure is chiefly the result of arterial tone and the heart action. Therefore, if the patient's heart action is normally strong, but the pulse rapid from loss of vasoconstrictor tone (low blood pressure), Momentary Treatment which constricts the abdominal vessels will at once slow the pulse (sometimes as much as twenty-five beats) but at the same time greatly strengthen the heart beat. A rapid pulse may exist also with hypertension if the heart has weakened as a result of the increased resistance. There will also be a high pressure with a rapid pulse in many acute conditions or after exercise; but this may be entirely the result of increased heart action.

Except with hypotension, if the pulse is rapid from some acute disturbance following cold, indigestion, and so forth, Prolonged Treatment will slow the pulse. After one treatment the pulse was slowed seventy-five beats per minute. Those with a chronic high blood pressure and good heart action have usually the smallest variations in the pulse, but everything depends on the degree of irritability of the nerve cells in the brain and spinal cord.

Just as the blood pressure in the brain depends primarily on general blood pressure, so also the pressure in the highly vascular spinal cord. If there is a loss of vascular tone in one spinal segment only, this area of the central nervous system must suffer from impaired nutrition. If the general blood pressure falls at all below normal, the anemia of this special area would be increased. If the general blood pressure rises above normal, the hyperemia would be greatest in this particular area. A patient's trouble may be confined to tissues or organs controlled by one or more spinal segments only.

Vasomotor centers in each segment of the cord, from the first dorsal to the lower lumbar, are dependent in a measure on their own activity for their normal blood supply, just as the chief vasomotor center in the medulla is dependent for its blood supply on its ability to maintain general arterial tone. After abdominal operations the whole or part of the spinal cord may be left in an anemic condition. With this condition sometimes one treatment may make marvelous improvement.

Both the blood pressure and the pulse must always be tested, because, often, lowering the diastolic blood pressure below normal might make an apparently stronger pulse; but it is more important to keep arterial tone at normal even if the pulse wave is not quite so full.

A large part of the statistics which have been collected in regard to blood pressure in different diseases, is of small value to one giving spinal treatment, because it is not stated whether the subnormal or even normal blood pressure is due to arterial hypotension or to a hypertension of the gastric and intestinal muscles, which may produce any degree of cardiac depression, or to a combination of the factors.

It follows, necessarily, from what has been said about the importance of the *rate* of blood flow, that it is no benefit to a patient with a high blood pressure to lower the pressure by weakening the heart action. A man may be temporarily better off with a blood pressure of 175, than with 125, because if the blood pressure is above normal, the patient is working against a serious handicap, and will suffer sooner or later if the blood pressure remains indefinitely above normal.

The blood pressure must be lowered by reducing the irritability of the particular abdominal vasomotor or visceromotor mechanisms which are responsible for the increased blood pressure. Often with cases of high blood pressure when the heart action has begun to weaken, the blood pressure may rise still higher temporarily after treatment. This is the result of the improved heart action following treatment which relaxed the pylorus and liberated a large amount of gas. Frequently, when

moving gas reaches a contracted intestinal ring the pressure of the gas causes a temporary rise in blood pressure.

From this it is evident that a single blood pressure test may be of small value. The blood pressure may be above normal on account of gas in the stomach and would be normal as soon as treatment liberated the gas; also the blood pressure may be apparently normal because the heart is depressed by gas or by years of overwork against a really great resistance. In other words, the blood pressure may be apparently low when the actual blood pressure would be very high if the heart were not depressed. It becomes obvious, also, that it is a fallacy to say, because lowering the blood pressure by drugs or hydrotherapy has proved injurious, that a certain case *demands* a high blood pressure.

It is obvious that sooner or later the high blood pressure on account of the extra work imposed on the heart, and the inevitable slowing of the circulation, will impair the nutrition of the central nervous system. It is only a normally rapid circulation of normal blood which can reduce the irritability of nerve centers. The best vascular tone (normal blood pressure with normal pulse) maintains the maximum nutrition of the nervous system; disturbed vascular tone means sooner or later excessive nervous irritability.

Dilating the blood vessels of the skin and of the skeletal muscles reduces the resistance to the heart action, accelerates the circulation, and reduces the irritability of the nerve cells in the spinal cord and brain.

This is true of a high or low blood pressure and this fact alone explains the beneficial effects of a large number of variously named forms of treatment. The perspiration which frequently occurs when the resistance to the heart action has become excessive is the result of dilatation of the cutaneous vessels and is obviously a protective mechanism for the overworked heart.

It may be that the dilatation of the blood vessels of the skin relieves the heart from too great a blood pressure. Most men find that they can work more comfortably and efficiently when they have

warmed up to the work, and some maintain that they work better when they begin to sweat.—Leonard Hill, p. 245.

Relaxing any large abdominal blood vessels, beyond normal, weakens the heart action sooner or later, usually at once, even though the general blood pressure remains above normal; this and other statements can be verified by treatment with pulse tracings and blood pressure tests. Relaxing abdominal blood vessels or gastric or intestinal muscles which are too much contracted always greatly improves the heart action. This is the most common condition to be met.

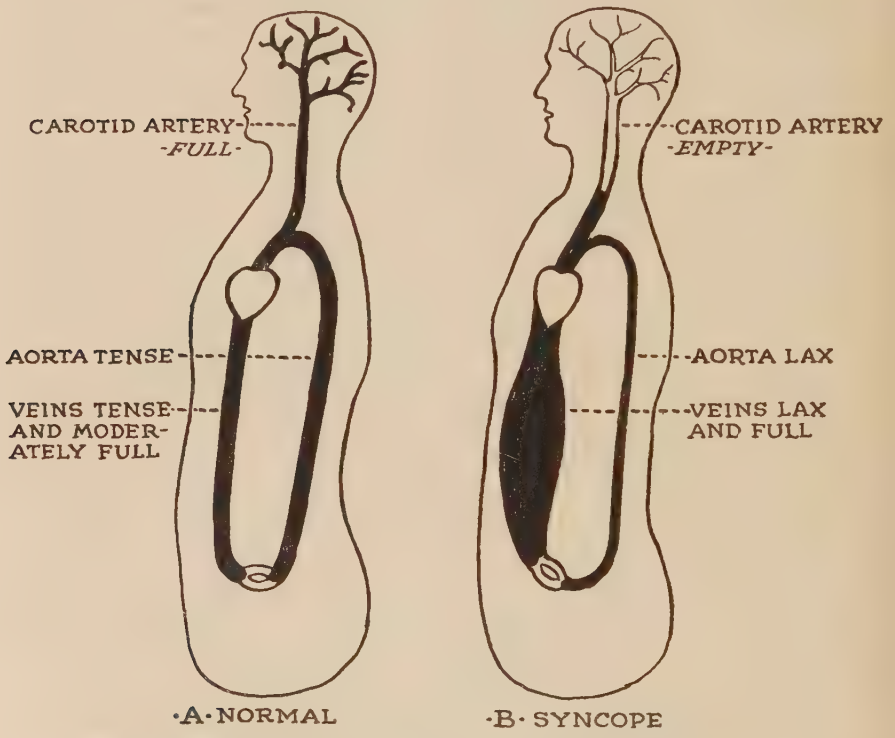


Diagram (from Lauder-Brunton) to show the changes in the circulation which occur when a person with arterial hypotension faints.

In addition it should be remembered that the spinal cord also becomes anemic. If the abdominal vessels have a chronic lack of tone, even if it is not extreme enough to cause syncope, there is slowing of the rate of the circulation which is proportionate to the lowered tension of the abdominal vessels. Sooner or later this slowing of the circulation will produce any degree of weakness of any part or all of the spinal cord or brain.

Many facts of physiology and pathology can be demonstrated only by treating spinal segments separately. No experiment with any drugs or baths can produce the necessary local effects. Whatever affects the abdominal circulation favorably, most powerfully relieves the irritability of the nerve cells in the brain and spinal cord. Many strenuous treatments and even abdominal operations may produce temporary improvement by causing active dilatation in local areas and lowering perhaps only the diastolic pressure, thereby relieving the work on the heart; but such results are purely accidental and do not restore the normal circulation exactly.

To understand the relation of the blood pressure and other tests of the circulation to symptoms, it must be remembered that very much depends on the *relative tone* of the blood vessels, in different parts of the body. For example, a man may have a high blood pressure but if the heart action is strong and there is a good tone in all the blood vessels of the brain and cord no symptoms can result. If any vessels of the brain or cord lose their tone and the general blood pressure is high, the greatest disturbances will result. A person may have even a normal blood pressure and have serious disturbance if there is a marked loss of tone in any cerebral or spinal vessels, but there is of course not the same danger of hemorrhage from rupture as when the blood pressure is high. But there is always possibility of the greatest functional disturbances and even hemorrhage in those with hypotension, because few if any blood vessels have the normal tone, and there is the greatest possibility of any vessel in the cord or brain relaxing extremely.

The normal blood pressure is 120 for adults, because that is the point the pressure tends to reach in all cases which are properly treated. If therefore the abdominal tension rises above this point, the resistance to the circulation is increased and the tendency is for the weakest vessels in the cord and brain to be most distended. Conversely, if the abdominal vessels dilate passively the circulation slows and the vessels of the cord and brain may also at first dilate passively, most excessively where there had been previously the least tone; ultimately the

cord and brain become anemic. The greater the degree of passive dilatation, the slower the circulation.

If there is a great loss of local vasomotor tone, as in catarrh of the nose, or as in catarrhal deafness or in bronchitis, cooler weather or the most insignificant draught may be enough to contract the external vessels and force blood into the relaxed vessels causing increased secretion or cough.

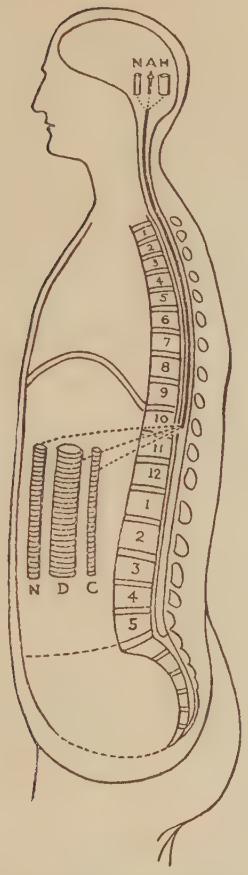
A hot bath may make one man sleep by dilating blood vessels and lowering a high blood pressure; with another person who has a loss of tone in the cerebral vessels, the hot bath may dilate the cerebral vessels and drive blood to the head by accelerating the heart action or cause more gas by dilating the gastric vessels, so that insomnia will result.

The contraction of at least external blood vessels caused by an altitude of only 2,000 feet, may slow the circulation sufficiently to aggravate seriously any nervous symptoms. Altitude may lower blood pressure if the heart action is weak; but to interpret properly the disturbance in the function of nerve cells we must constantly bear in mind the rate of the circulation and the *relative* tone of local vascular areas and not consider the general tone of the vascular system only.

As a low blood pressure commonly precedes tuberculosis, so no local or general pathological condition can improve when the blood pressure is much below normal.

Many patients with a subnormal blood pressure are being treated by specialists for local troubles, but without benefit, because just as local treatment, as for the eye or stomach, would be of small value for a man in a faint, so relatively, though in a less degree, local treatment is futile for patients with a low or a very high blood pressure; and many of these local symptoms would disappear if the circulation were only maintained at normal.

As has been stated, it is not variations simply in the pulse or blood pressure which cause or aggravate symptoms, but it is the variation in the *rate of flow* of the blood. Testing the pulse, blood pressure, and abdominal conditions are only means to determine whether the rate of flow is increased by treatment.



N—Normal tone of cerebral arteries and of abdominal arteries.
A—Cerebral Anemia resulting from
D—Dilatation of abdominal arteries. This anemia irritates the vasomotor center and causes the abdominal arteries to contract to normal.
C—Constriction of abdominal arteries producing
H—Hyperemia of cerebral arteries. This hyperemia irritates the nerve center and causes the abdominal arteries to dilate.

Diagram to illustrate the nervous mechanism which under ordinary conditions maintains the normal blood supply of the brain. The vasomotor center is not only excited reflexly but responds to every change in the circulation through the spinal bulb. A rise of pressure in the cerebral arteries provokes a fall of aortic pressure; conversely, a fall of pressure in the cerebral arteries provokes a rise. In other words, cerebral anemia, *however produced,* excites the center and increases vascular tone, while cerebral hyperemia decreases vascular tone.—Shaefer's "Physiology."

If the mechanism fails to respond from exhaustion of the vasomotor center or of the subordinate centers in the cord, syncope or some degree of hypotension results.

If the vasoconstrictor nerve cells in the cord, which are in health controlled by the vasomotor center in the medulla, become excessively irritable from fatigue or malnutrition, they constrict the abdominal blood vessels, causing an increasing resistance to the heart action, and decreased rate of nutrition of the whole nervous system and ultimately hyperemia or congestion of the brain, kidneys, or other organ, or exhaustion of the heart.

It is the *deficient* flow or quality, not the pressure of blood which leads to œdema, degeneration, distension of the venous wall, and varicose veins, in those whose occupation requires them to stand for long periods of time.—Leonard Hill, p. 130.

Neither the blood pressure nor the pulse alone is a safe guide in giving treatment, and even if the pulse and blood pressure are apparently normal, palpation of the stomach and intestines and spinal muscles is necessary to detect the location and amount of the abdominal resistance to the circulation.

A normal blood pressure with a weak pulse may be a serious condition if it means the abdominal resistance is too great for the heart action.

Just as impaired nutrition of the vasomotor centers produces an excessive irritability of these centers and therefore a rise in blood pressure in one class of people and in the other class a weakness of those nerve centers resulting in a fall in blood pressure, so in constipation, impaired nutrition may cause the "spastic" form or the "atonic" form; so also in abdominal or spinal muscles, impaired nutrition produces either increased tension or relaxation. These apparently opposite results are stages in the same process of malnutrition, the increased tension being the first stage, the muscular relaxation being the latter. The cardiac and gastric muscles may go through similar changes.

The more or less prolonged weakness which follows or develops gradually after any severe illness is due to the general or local vascular disturbances following the illness.

The regular stages of improvement through which the circulation passes are most instructive (see Summary of Conditions of the Circulation). The degree of fall of blood pressure from the first, even lightest, Momentary Treatment with the finger is an exact test of the loss of vasomotor tone, and is therefore a test of a man's vitality. Sometimes when the blood pressure was normal the lightest possible Momentary Treatment has caused a drop of 40 mm. This showed great vascular weakness, even in people who had been declared well because the blood pressure happened to be normal at the time of examination.

Mental effort may keep the blood pressure for the time being at normal in cases of extreme hypotension, but the greater the fatigue, the greater the drop in blood pressure when rest is taken. Such people are often too exhausted to rest properly.

The usual immediate cause of most fluctuations in the blood pressure is the incarceration of gas. This will be discussed under the head of "Flatulence." As a matter of fact, unless every treatment relaxes constrictions of gastric and intestinal muscles and allows the gas to move along, the pulse and blood pressure will not come to normal.

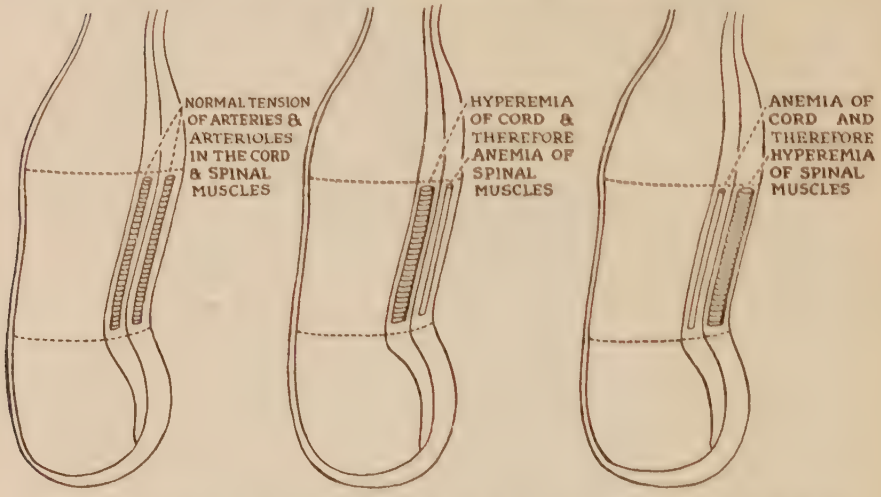
Eating ordinarily raises blood pressure, according to most observers, or it at least makes a more rapid flow of blood through the brain; not, however, if the eating causes sufficient flatulence or indigestion to depress the circulation. This fact at once exposes the fallacy of the theory that the immediate strengthening effect of eating is psychic because there has been no time for the assimilation of nourishment. Anything, even a pure stimulant, whether a drug or mere excitement, if it accelerates the rate of flow of blood through the brain makes one feel stronger for the time being.

This explains why some patients feel better and some worse after eating. Eating also starts the peristaltic wave in the stomach and bowel and liberates gas which always depresses the circulation wherever it is incarcerated.

From the immediate response to treatment of the segments involved, it is possible very soon to decide whether the disturbance of pulse or blood pressure or both is from gas in the stomach or in the bowels.

As Lauder-Brunton has shown (p. 118) that in migraine there is a contraction of a peripheral and dilatation of a central part of the temporal artery and the pain is caused by the stretching action exerted on the artery by the blood which tries to pour into it from the dilated carotid, so in anyone whose vasomotor centers have become sufficiently irritable, contraction of any part of any artery may occur from fatigue, cold, excitement, indigestion, or trauma. This would explain the abdominal pain

BALANCE BETWEEN THE BLOOD SUPPLY OF THE SPINAL CORD AND THE SPINAL MUSCLES


NORMAL TENSION OF ARTERIES & ARTERIOLES IN THE CORD & SPINAL MUSCLES
HYPEREMIA OF CORD & THEREFORE ANEMIA OF SPINAL MUSCLES
ANEMIA OF CORD AND THEREFORE HYPEREMIA OF SPINAL MUSCLES

The most valuable therapeutically of all the compensatory balances of the circulation is the balance between the blood supply of the spinal cord and the spinal muscles. Anemia or hyperemia of the spinal cord, however produced, disturbs the functional activity of all nerve cells and may therefore disturb the blood supply or the function or any part or all of the body. Consequently if the hyperemia or anemia can be controlled to any extent by spinal applications, we have the most powerful means of controlling the blood supply, muscular contract, secretion, growth, and all functional activity of any tissue of the body. It affords a means of restoring to normal strength all nerve cells which have been weakened by illness, overwork, or starvation. It is a method of retarding the progress of organic and senile changes and of preventing those organic changes which are the result of longstanding weakness of any controlling nerve centers.

in advanced stages of high tension, though the simultaneous contractions of the intestine may also cause any degree of pain.

Gas is incarcerated wherever the visceromotor nerves are most irritable; gas in the stomach or intestines, therefore, may irritate simultaneously both the visceromotor and vasomotor nerves from any segment, segments, or half segments.

When either or both of these sets of nerves become sufficiently irritable, indigestible food, or, if the nerves are very irritable, almost any food, or simply gas, which is manufactured out of the blood, will be sufficient to excite any degree of gastric or intestinal contraction, or of arterial contraction or dilata-

tion; hence the benefit of a careful diet in many cases, provided the nutrition is not so diminished that the irritability of the nerves is thereby increased.

Sometimes incarcerated gas affects chiefly the heart action directly, and sometimes chiefly the abdominal blood vessels—usually both. If there is a low vascular tone of the abdominal blood vessels, gas commonly increases the vasodilatation, with a consequent fall in blood pressure and acceleration of the pulse. If there is a good tone of the abdominal vessels, or if the abdominal or pelvic vasomotor nerves are very irritable, gas may cause vasoconstriction with a consequent slowing of the pulse. A rapid pulse disguises or compensates for the low tension.

As one treats a case of low blood pressure, it will be seen that as the patient improves, the same amount of gas which lowered the blood pressure and accelerated the pulse at the beginning of treatment will raise the blood pressure and slow the pulse when there is greater vascular stability. An excessive amount of gas or extreme chronic abdominal vasoconstriction ultimately produces a weak, rapid pulse as the heart weakens on account of the excessive resistance.

The abdominal resistance may be enormous and yet the blood pressure normal, because the heart action is weakening, therefore angina may develop with any blood pressure, but there would probably have been some antecedent period of hypertension and the heart action would be weak or rapid or irregular if the heart is weakening.

As long as possible, the circulatory apparatus endeavors to maintain a uniform rate of blood flow through the brain and spinal cord; therefore as the abdominal resistance rises the heart action becomes heavier, to the limits of its strength; if the resistance continues, the heart action becomes weaker and more rapid.

Sometimes Prolonged Treatment, which liberates gas but also lowers the blood pressure below normal, may make the pulse temporarily stronger, but later the pulse becomes weaker because of the additional hypotension. If the visceromotor nerves are very irritable, the gas may be under enormous pressure in

the stomach or in some intestinal loop and the disturbance of the pulse or blood pressure seems to be in proportion to the intensity of the muscular contraction. Even a small amount of gas in any part of the abdomen or pelvis, if tightly held, may cause a great rise or fall in blood pressure. The tone of the arteries and incarcerated flatulence determine the rate of the pulse; thus with hypotension and rapid pulse, the arteries must contract in order to slow the pulse. If the blood pressure is high and the heart weak, the blood pressure may not begin to come down to normal until the heart action has become stronger, because only the normal rate of flow of the blood can reduce the irritability of the vasomotor nerves.

Patients who at first had a blood pressure which fluctuated between 40 and 70 mm. from cold, indigestion, fatigue, and excitement, or from some slight vasomotor tests, after treatment have not varied more than 5 mm., when resting, at any time in several months.

If blood pressure is chronically high, either mental or muscular work raises blood pressure unless the heart is weak; but the rise from mental efforts is usually the result of increased vasoconstriction and is therefore injurious, whereas the rise from exercise is due partly to increased heart action, which should be beneficial since it improves the nutrition of the whole nervous system, if the exercise is not too sudden, too violent, or too prolonged for the individual.

During some efforts the pulse may disappear at the wrist owing to the compression of the arteries by the forcible contraction of the muscles and the hindrance offered to the free passage of the blood through the heart. For these reasons it is necessary to consider the nature of the muscular exertion in any discussion of its effects on blood pressure.—Leonard Hill, p. 234.

High blood pressure is not compensatory or necessary with nephritis. As treatment reduces the resistance to the circulation, the urine tests are always better.

Oculists have watched the intraocular tension come down as the general blood pressure was reduced by venesection. Why not lower the blood pressure by treating the spinal segments

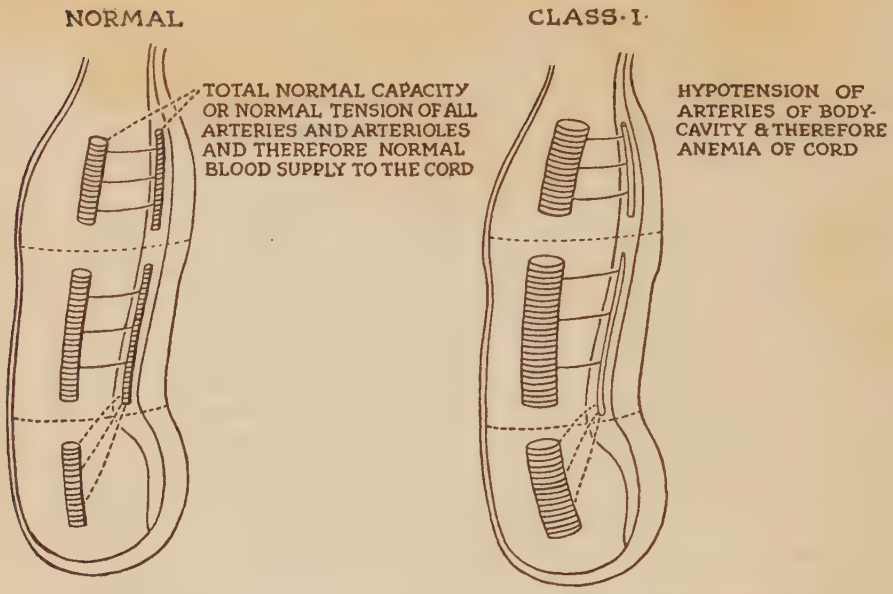
responsible for the rise and save the patient's blood? It is doubtful whether the amount of blood is actually excessive, because high blood pressure may be due entirely to nervous irritability.

It is best to count the pulse and test the blood pressure before testing the grip with the dynamometer, because sometimes the blood pressure or pulse is greatly disturbed by the mental effort; for this reason, as a rule, it is best not to use the dynamometer after treatment, because the mental effort might destroy some of the effect of the treatment. For the same reason, with some nervous patients with high blood pressure it is best not to test the blood pressure after treatment. All blood pressure tests should be made with patients as nearly as possible in the same position each time and making some allowance for recent exercise, eating, fatigue, or excitement, or the novelty of the first test, which might, like all mental stimuli, cause a rise in blood pressure, or a fall, if the patient is weak and has a tendancy toward low blood pressure. A convenient position for office practice is a Morris or other slightly reclining chair. The writer has used either a mercury column sphygmomanometer for office work or an aneroid instrument, the "Tycos," for its portability, for patients confined to the bed or house.

PART 3

Summary of Chronic Conditions of the Circulation

Before giving a treatment it is necessary to know whether the spinal cord is anemic, in part or as a whole, or whether it is hyperemic. The condition of the circulation of the blood in the spinal cord and brain in all pathological conditions, with or without heart complications, may be included in four classes. In addition to the separate spinal segments, there are three vascular divisions of the spinal cord and of the parts of the body which they control, which are frequently separately disturbed. The upper six dorsal segments form one division, controlling the blood supply to the head, thorax, and arms; the six lower dorsal with the lumbar form the second division and control the abdominal circulation; and the third division, con-


NORMAL
CLASS·I·
TOTAL NORMAL CAPACITY OR NORMAL TENSION OF ALL ARTERIES AND ARTERIOLES AND THEREFORE NORMAL BLOOD SUPPLY TO THE CORD
HYPOTENSION OF ARTERIES OF BODY-CAVITY & THEREFORE ANEMIA OF CORD

From the second dorsal segment to the coccygeal nerve, the entire length of the spinal cord, are located vasoconstrictor and vasodilator nerve cells, which are subordinate to the chief centers in the medulla. These subordinate nerve cells control the blood supply in every part of the body to some extent, independently of the chief centers. Each segment of the spine controls a segment of the body. Just as there is a balance between the blood supply of the abdomen and the brain so also if the blood vessels of the abdomen or legs relax or passively dilate, the vessels of the controlling segment of the cord contract. The heart starts the pulse wave but it is the contraction of the arterioles which chiefly propels the blood through the body. If the arterioles relax the movement of the blood slows and the blood pressure falls. This condition of the circulation will be called Class 1.

sisting of the sacral and coccygeal segments, controlling the blood supply of the lowest part of the abdomen, the pelvic region, the hips, and the legs.

The reestablishment of the normal circulation in each spinal segment is just as important and beneficial even if there is a valvular defect in the heart, because it is the greatest possible assistance to the heart in its effort to compensate, if the arterial resistance is brought to normal.

Class 1

There is a general anemia of the spinal cord and brain from general hypotension. The systolic pressure is usually below

TREATMENT FOR CLASS 1

Anemia of the brain and spinal cord which is the result of general arterial hypotension (relaxation of blood vessels). Always accompanied by some visceral ptosis (falling of organs). To contract relaxed blood vessels in the interior of the body the alcohol must be applied locally. If the entire skin is cooled the blood is driven from the exterior of the body into the interior and exactly the wrong effect is produced. As a substitute for alcohol any cold object may be held for a few seconds against the spine by the patient in bed. A bottle of cold water is convenient. After spraying the alcohol, one should blow so as to rapidly evaporate the alcohol. Occasionally the shock from the sudden cold is excessive. In that case apply the alcohol with absorbent cotton.

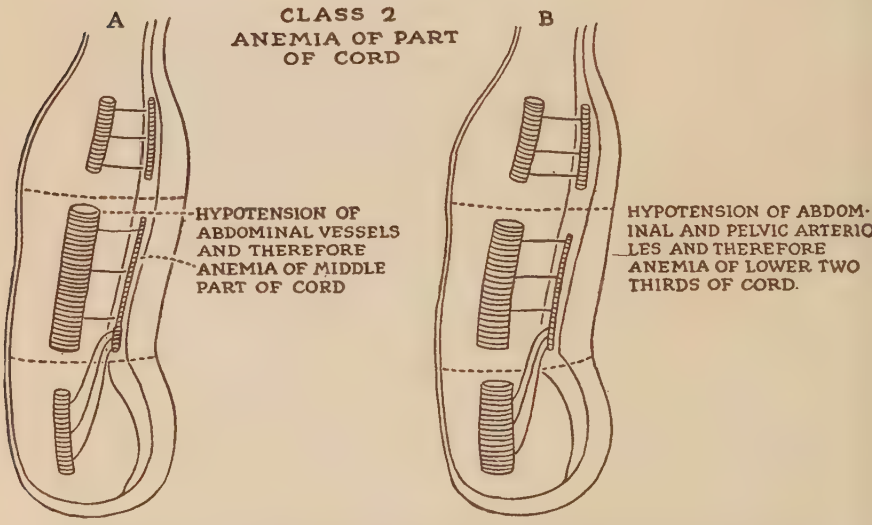
120 mm.; but often the blood pressure is normal or above normal, sometimes it is as high as 170 mm., because if there is great pressure from incarcerated gas or if the pulse is faster than normal (normal is 72, 66, or 60) the loss of vasomotor tone is disguised, or compensated for, by the increased intra-abdominal pressure, or by the extra force or number of the heart beats. The diastolic pressure is usually below 80 mm., unless there is a large amount of gas. Momentary Treatment at once liberates the gas and the diastolic pressure falls below 80 mm. This condition requires alcohol on the spine, because, if there is very great loss of tone, any finger or other mechanical treatment will lower the blood pressure.

If a person is in Class 1, fatigue, cold, excitement, indigestion, and gravitation are all likely to lower the blood pressure. In the process of recovery those in Class 1 pass first into Class 2, then into 3 or 4, as they acquire a stronger vasomotor tone, and there is a tendency to higher blood pressure if any attack of flatulence occurs. Finally all in Class 1 pass into Class 4, in which at first the visceromotor nerves are very irritable. Usually the hypotension of Class 1 represents a greater degree of fatigue or weakness of the nerve cells than of other classes, but people in any class may be found with any degree of starvation of nerve cells. Usually if there is a tendency to hypotension, extra gas will lower the blood pressure. If there is a tendency to hypertension, extra gas will raise the blood pressure, but if there is a great amount of gas in the stomach pressing against the heart, the blood pressure may not rise and will perhaps fall, even in cases of hypertension, because the force of the pulse is depressed. As soon as the arteries contract sufficiently those in Class 1 pass into Class 2 (having hyperemia of one or two of the three divisions of the cord). This is because the blood is forced from the contracting abdominal vessels into the previously anemic cord. As soon as a patient passes from one class to another, treatment must be immediately reversed or stopped for the segments involved. Momentary Treatment, with the finger, which at first lowers the blood pressure for an extreme case of hypertension, will, as the

patient improves, raise the blood pressure. Cool weather or a slight altitude accelerates the rate of improvement.

Class 2

There is here an anemia of some segments and a hyperemia of others. Usually there is an anemia of the segments from the sixth dorsal to the fifth lumbar segment, producing abdominal hypotension; but with hyperemia of the upper six dorsal segments and hyperemia of the sacral segments. This condition requires Momentary Treatment for the segments from the sixth dorsal to the fifth lumbar and Prolonged Treatment for the upper six dorsal and the sacral segments. As patients pass out of Class 1, usually all the upper six dorsal or all the sacral segments begin simultaneously to require the Prolonged Treatment. The systolic blood pressure may be anywhere from 80 mm. to 200 mm. and the diastolic frequently below 80 mm., but frequently above, depending on the degree of relaxation of the


A
CLASS 2
ANEMIA OF PART OF CORD
B
HYPOTENSION OF ABDOMINAL VESSELS AND THEREFORE ANEMIA OF MIDDLE PART OF CORD
HYPOTENSION OF ABDOMINAL AND PELVIC ARTERIOLES AND THEREFORE ANEMIA OF LOWER TWO THIRDS OF CORD.

Just as the brain and entire spinal cord become relatively anemic when there is a lack of tone in the blood vessels of the whole body cavity, so also parts only of the spinal cord may become anemic if the thoracic, abdominal, or pelvic blood vessels lose their tone. Anemia of any part of the cord will produce an immediate or gradually increasing weakness of all nerve cells located there.

TREATMENT FOR CLASS 2

A

B

Anemia of middle or lower two-thirds of spinal cord the result of a partial arterial hypotension. The dividing line between the upper and middle thirds of the spine is about the level of the lower angles of the shoulder blades. The upper edge of the hip bone is the dividing line between the middle and lowest thirds. If a man in Class 2B had sciatica the cold treatment (Momentary Treatment) would be required for the middle third and gentle Prolonged Treatment for the lowest third. A mistake of one inch would aggravate instead of relieving the pain.

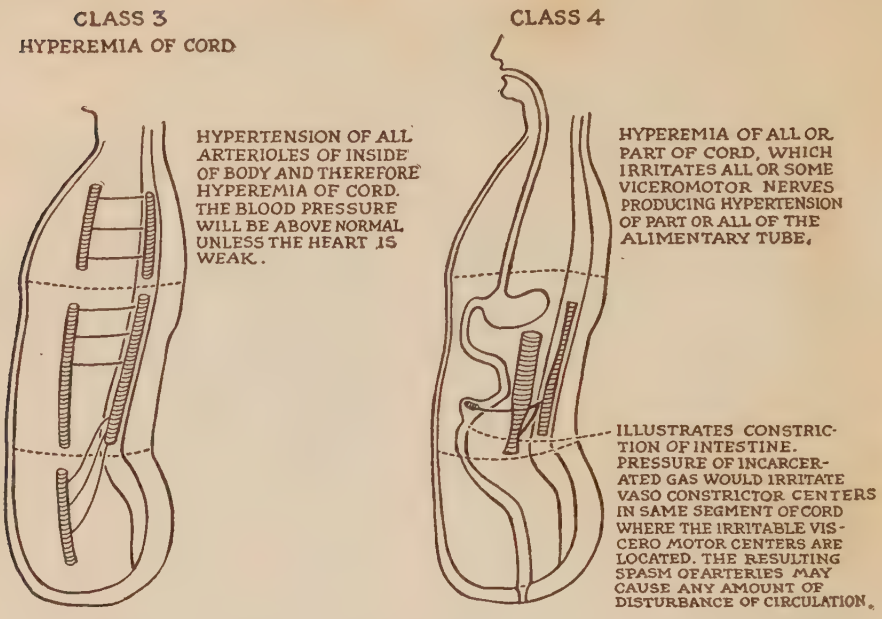
abdominal vessels and the strength of the heart to work against the resistance produced by gas held in the stomach or in the bowels. Usually the blood pressure is about normal, because the opposite vascular conditions in the different areas compensate for each other. So even with a normal blood pressure, a patient may have sufficient depression of the circulation to produce insanity or some other serious trouble. If the *diastolic* pressure is low it indicates, if a *chronic* condition, a passive dilatation of the abdominal vessels and therefore requires Momentary Treatment for that area; or it may indicate an active dilatation. This occurs in all acute attacks and always requires Prolonged Treatment.

There is the same relation between the abdominal vessels and the vessels of the controlling dorsal or lumbar segments as between the abdominal vessels and the brain. As the abdominal vessels passively dilate, both the brain and the controlling part of the cord become anemic, if the heart action remains uniform, but this draining of the blood from the cord and brain may not be sufficient to produce an anemia of the sacral or upper dorsal segments.

Sometimes when the uppermost third of the spine requires Prolonged Treatment and the middle third requires alcohol, the lowest third will also require alcohol; most rarely when the lowest third requires Prolonged Treatment the middle and upper thirds have required alcohol. These mixed conditions come properly under Class 2.

Class 3

There is a passive hyperemia of all disturbed segments as a result of hypertension of abdominal and perhaps all other blood vessels of the body. The systolic pressure is usually above 150 mm. and the diastolic above 80 mm., unless the heart is getting weak. If the heart is weakening and the blood pressure has fallen below normal this condition (sometimes called "secondary hypotension") requires Prolonged Treatment because it is due to an actual hypertension. Classes 3 and 4 require general Prolonged Treatment, but if the nerves are very irritable, the


CLASS 3
HYPEREMIA OF CORD
HYPERTENSION OF ALL ARTERIOLES OF INSIDE OF BODY AND THEREFORE HYPEREMIA OF CORD. THE BLOOD PRESSURE WILL BE ABOVE NORMAL UNLESS THE HEART IS WEAK.
CLASS 4
HYPEREMIA OF ALL OR PART OF CORD, WHICH IRRITATES ALL OR SOME VICEROMOTOR NERVES PRODUCING HYPERTENSION OF PART OR ALL OF THE ALIMENTARY TUBE.
ILLUSTRATES CONSTRICTION OF INTESTINE. PRESSURE OF INCARCERATED GAS WOULD IRRITATE VASO CONSTRICTOR CENTERS IN SAME SEGMENT OF CORD WHERE THE IRRITABLE VISCERO MOTOR CENTERS ARE LOCATED. THE RESULTING SPASM OF ARTERIES MAY CAUSE ANY AMOUNT OF DISTURBANCE OF CIRCULATION.

The gas which causes trouble is carbon dioxide. It is diffused from the walls of the stomach according to the dilatation of the blood vessels. Gas pressure causes first contraction of the pylorus or any intestinal ring. Little attention is usually paid to the gas until it produces distention, but distention is the necessary result of some constriction if a patient is in Class 4. Those in Class 1 (General Hypotension) have a relaxed alimentary tube, hence those distentions are not the result of constriction and require opposite treatment from the distentions of Class 4. Everyone recognizes the extra work and danger for the heart for those in Class 3 if the hypertension of the arteries is great, but the risk for those in Class 4 may be just as great even with a normal blood pressure. A nervous heart may be the result of great contraction of some part of the alimentary tube.

treatment must be given very gently. As the blood pressure approaches normal, after one or more treatments, there is sometimes danger of relaxing the abdominal blood vessels too much and perhaps incidentally increasing the production of gas, and if so, Momentary Treatment must be resumed. Otherwise some in Class 3 or 4 would be brought into Class 2.

The limit of life in most people is the increasing irritability of the vasomotor and other nerve cells whereby the circulation is literally strangled by the contraction of the abdominal blood vessels. This condition is ultimately termed "arteriosclerosis,"

The patient must lie on the side to relax the spinal muscles on the upper side. Both arms and both shoulders should be drawn loosely toward the front of the body. The whole body should be in a straight line. The treating bench should not be hard or cold. The patient should be kept warm with a blanket in addition to the usual clothing, excepting the coat and vest or the corset. A kimona is better than any tight-fitting dress. The object of Prolonged Treatment is to produce the maximum dilatation of the blood vessels in the spinal muscles, with the minimum irritation of the nerves. The kind and amount of Prolonged Treatment must be regulated according to the existing irritability of the nerve cells in each spinal segment. One patient or one segment may require firm pressure, or massaging or considerable heat or counterirritation. Another patient's whole spine or any one segment may require the gentlest possible and absolutely motionless pressure of the hand. Some patients can have no heat, others no counterirritation. The irritability of each kind of nerves must be considered also. If a patient has ever had any degree of heat prostration, any heat on the spine may excite the vasodilator nerves in any weak area of the body and might dilate the cerebral blood vessels or the gastric blood vessels and produce any amount of gas and consequent disturbance of the heart action. The most insignificant pain or even unconscious irritation of any nerves may cause extreme fluctuation in the circulation, especially in those with high or low blood pressure or a sensitive nervous system. (See Warnings.)

but primarily it is not different from the contraction of any other muscles, because the deposition of mineral matter does not necessarily prevent all relaxation of muscles. The same result may be produced at any period of life by "acute indigestion" which similarly, and by interfering with the heart action, stops the circulation.

Class 4

The most difficult but vitally important test, is to distinguish Class 4 from Class 1. The blood pressure, pulse, and muscular contractions may appear similar, but the pylorus and intestines will be more contracted and retracted than in those in Class 1, because in this condition the visceromotor nerves are more irritable than the vasomotor. The systolic pressure is usually about 120 mm., occasionally higher, more often lower; the diastolic is usually above 80 mm. The pulse pressure is often only 20. Those whose pulse was 80 to 100 in Class 1 may have it drop as low as 50 when they reach this stage. When the vasomotor nerves of those in Class 1 have recovered, there is this fourth condition of the circulation, but this is the result of excessive irritability of the *visceromotor* nerves. If these nerves contract the stomach or bowels unduly, then Prolonged Treatment must be used to relax the contractions. It is a most extraordinary fact that frequently those who had hypotension, and could have only alcohol applied to the spine, after one or more applications of alcohol which overcame the vascular relaxation, at once required the hardest possible Prolonged Treatment to relax the contractions of the intestines and stomach. A few hours before, the same Prolonged Treatment would have lowered the blood pressure and left the patient in a very serious weak condition. Sometimes this change occurs after a single application of alcohol; sometimes in very weak patients not until after several months, during which time the vasomotor tone was gradually improving. When this stage is reached patients should be given Prolonged Treatment wherever and whenever the gastric and intestinal muscles contract sufficiently to incarcerate the gas and thereby depress the heart action. If

patients who had been in Class 1 are given too much Prolonged Treatment, especially for the abdominal segments, they will be thrown back from Class 4 into Class 1, especially if too much fatigued. In such a case the use of the cold on the spine must be resumed until the patient has passed again from Class 1 to Class 4. Since the vasomotor nerves must recover first, it is natural, as soon as they have recovered, that the visceromotor nerves should be the next in order and therefore require primary attention, care being taken, however, not to bring back the previous condition of low arterial tension. Even though the blood pressure is normal, the strain on the heart in Class 4 may be as great as with a high blood pressure.

PART 4

Summary of Acute Disturbances of the Circulation

Class 3

This will be called Class 3 because the same form of treatment is required for these acute conditions as for those in Class 3 of chronic conditions. With any acute infectious condition, with fever or a hard cold, all acute attacks, as of indigestion, neuritis, headache, "rheumatism," and the like, patients in all four classes require Prolonged Treatment for every segment, usually, of course, more for some segments than for others, wherever the condition is most acute. But patients who previously had had a marked hypotension will need Momentary Treatment for an anemic headache, asthma, or cramp of gastric or any intestinal muscle, or "appendicitis" from gas. Several applications of alcohol at short intervals may be needed to control the attack.

With those in chronic Class 1 (hypotension), if exposed to a slight chill, the cold forces more blood into the relaxed abdominal vessels and may cause no symptoms except perhaps a lower blood pressure with an increase in the chronic mental depression or weakness or chilliness, or other nervous or mental disturbances. These symptoms are just as much the effect of chill as rhinitis or pneumonia. If treatments have begun to overcome the chronic relaxation of the abdominal vessels, such

patients if exposed to a similar chill are most likely to have a condition described under Class 2, as follows, because the blood is not driven as formerly into relaxed abdominal vessels:

Class 2

When those of Class 2, of chronic conditions, have a *slight* chill, it drives some blood into the abdominal vessels, producing an increased anemia of the segments from the sixth dorsal to the fifth lumbar, with hyperemia of any upper dorsal or sacral segments. This condition requires Momentary Treatment for the abdominal areas and Prolonged Treatment for whichever upper dorsal or sacral areas are hyperemic, but usually for such a disturbance, a *general* Prolonged Treatment is required.

Very careful tests must be made with those in Class 1 or 2 before giving treatment. The foregoing facts resulting from daily observation of every patient show that the contraction of external blood vessels, caused in sensitive people by the most insignificant and usually unnoticed chill, forces the blood to the weakest vascular area. To limit the definition of "cold" to a cold in the head, or only to gross vascular changes, and to attribute most pathological conditions primarily to infections, resulting toxins, "rheumatism," or heredity, entirely misdirects the attention of all concerned.

Cold may dilate the blood vessels in any part of the spinal cord, and affect any or all of the nerve cells in any one or any half segment, or in all of the segments; or it may affect only vasomotor or only visceromotor or only musculomotor cells scattered the entire length of the cord; or it may affect any combination of these cells. No two conditions are likely to be exactly alike and symptoms can never be properly understood or treated unless regarded from the standpoint of the spinal cord.

A severe illness with fever, which always causes at least a temporary hyperemia of the cord, may leave a permanent hyperemia of the cord, thereby causing people with a previous hypotension (Class 1) to pass into Class 4 (viscerohyperten-

sion). Living in cold air or a high altitude has overcome hypotension in many people.

In any case, if the blood pressure or the pulse is disturbed, palpation of the abdomen will determine the location of the flatulence retained by muscular contractions, which is the cause of, or coincident with, the change in circulation.

When in doubt whether to give Momentary or Prolonged Treatment, it is safest to try Momentary Treatment for one-half only of the abdomen. If this increases the soreness or tension of the abdominal muscles on that half of the abdomen, it proves that it was the wrong treatment. If Prolonged Treatment is given for the controlling segment, the gas will move on and the soreness disappear, whether the cord is anemic or hyperemic. If, next, Momentary Treatment is given, the soreness will immediately reappear if the segment of the cord has been chronically hyperemic or was temporarily hyperemic from cold, but the soreness will not reappear after Momentary Treatment if the cord was anemic, and the soreness was due, therefore, to the pressure of excessive amounts of gas, which is to be expected with general hypotension.

Even after the vasomotor nerves have recovered, any degree of disturbance in the circulation may be produced by the irritability of the visceromotor nerves which contract the gastric and intestinal muscles whenever they are stimulated by the presence of extra gas, or by cold, fatigue, or excitement. The pressure of the incarcerated gas probably irritates the vasomotor nerves also and raises or lowers the blood pressure, according to the location and the amount of the gas and the irritability of the nerves and the strength of the heart, but as the blood pressure approaches normal, because the vasomotor nerves have become less irritable, the fluctuations in the circulation are not as great even with very considerable contractions of the stomach or intestines. Occasionally, with extreme amounts of gas, one must wait an hour or two and make tests after allowing this time for the movement of gas and other changes to occur.

To test the effect of treatment for the upper vascular area (first to sixth dorsal segments) palpate the cervical muscles.

The wrong treatment will increase and the right treatment will decrease the tension of these muscles.

To test the middle vascular area (seventh dorsal to fifth lumbar) test the intestinal tension before and after treatment.

To test the effect of treatment of the lowest vascular area (the sacral) test the intestinal tension in the lower third of the abdomen.

It is sometimes very difficult to decide whether a patient with a blood pressure at or near normal requires Prolonged or Momentary Treatment. If the pulse is soft and compressible and more than 72 and the abdomen sensitive, apply alcohol to the lower dorsal segments only. If this treatment slows and strengthens the pulse, brings the blood pressures nearer to 120 and 80, and diminishes the abdominal soreness, it is the correct treatment.

One should remember, however, that sometimes patients in Class 4 (with hypertension of the visceral muscles) may be apparently benefited but soon after be made worse by this treatment; the heart may begin to beat more heavily and slower to overcome the increased resistance caused by the Momentary Treatment. The intestines also may contract still more and be retracted from the abdominal wall so that the abdomen may feel softer and less sensitive to a light pressure of the fingers.

After every treatment the distension of the intestines should be reduced, the pulse stronger and nearer normal, and the blood pressure nearer normal, allowing for changes in the pulse.

Sometimes there will be no proper response to treatment until the patient has belched up some gas.

If Momentary Treatment increases the existing disturbance in the pulse, blood pressures, or muscular contractions, Prolonged Treatment will easily correct the mistake, but if one begins with Prolonged Treatment for a case of hypotension it may take several applications of alcohol to correct the mistake.

Sometimes the presence of gas in the stomach will keep the diastolic pressure up to 80 even with great arterial hypotension, but if the diastolic pressure is 90, the patient usually is in Class 3 or 4, and requires Prolonged Treatment.

Brief Summary

To treat any chronic trouble with the circulation in Class 1 (hypotension) (*e.g.*, cough, or neuritis in the arm) controlled by one or more spinal segments, if the blood pressure is very low or falls easily, apply alcohol to the spine.

In Class 2, if the blood pressure is normal or even varies from 90 to 160, give Momentary Treatment for abdominal vessels, with Prolonged Treatment for the special segments.

In Class 3, if the blood pressure is high, give Prolonged Treatment for all necessary special segments until the blood pressure has been reduced to normal.

In Class 4, since Prolonged Treatment relaxes gastric and intestinal muscles, as well as blood vessels, just enough Prolonged Treatment is required to liberate the gas.

For All Acute Attacks give Prolonged Treatment wherever needed for local symptoms, and usually treat all the segments, unless there has been a general hypotension (Class 1). This latter condition may require alcohol.

Even if an acute attack is in a limited area, as for instance facial neuralgia, it is of primary importance to bring the general circulation to normal before or in addition to treating the local trouble.

PART 5

Further Facts in Regard to the Circulation

The gray matter of the spinal cord and brain is exceedingly vascular, even when contrasted with the adjacent white matter. This fact of anatomy agrees with the physiological fact that:

> The nerve cells are extraordinarily dependent on oxygenated blood. . . . The more the circulation is studied, the stronger is the conviction that it is not a fixed state but a sensitive equilibrium, the result of constantly varying action of a great number of factors.—W. D. Porter.

This latter fact is quite as true of the highly vascular spinal cord and brain as of any other tissue. When any variation in this sensitive equilibrium occurs, it must, from the nature of the functions of the cell bodies, produce great peripheral changes, for we must constantly bear in mind that the cell

bodies of the spinal cord and brain control the blood supply, nutrition, growth, secretion, and functional activity of all the tissues of the body. Conversely, variations in the functional activity of any organ or tissue, if maintained for any time, must indicate a variation in the blood supply to the nerve cells, because cells cannot maintain increased activity without increased blood supply to furnish energy, whether it is a muscle or a nerve cell.

The following facts in regard to the circulation, which can be verified in standard medical works, are mentioned because they explain many symptoms and answer many questions. Either congestion or anemia of the brain, if sufficiently acute, may cause convulsions or hemorrhage. Lumbago, or any other severe muscular contraction of external or internal muscles, may be caused either by anemia or hyperemia of the cord. This shows that it is the slowing of the rate of the circulation which irritates nerve cells.

Within physiological limits an increase in blood supply means an increase of function. In an active muscle the blood vessels are dilated and three or four times the usual amount of blood passes through them. In summer, because there is more blood in the skin than in winter, the hair and nails grow faster. Less blood goes also to the kidneys in summer. A high altitude has the effect of cold to some extent. Passive hyperemia increases the growth of bones. This shows how even the growth of bones is controlled by the vasomotor nerves. It is the hyperemia of the mucous membranes which excites the coughing or sneezing and the increased secretion. Cutting the vasoconstrictor nerves in one side of a cat's nose causes increased redness and secretion in that side.

When hyperemia becomes congestion, the function of a tissue or organ is diminished or stopped; as congestion of the lungs in pneumonia, the kidneys in nephritis, or the dryness of the throat in the first stages of a cold. As the congestion of the mucous membrane diminishes, there is excessive secretion because of the hyperemia.

Consciousness depends on a sufficient blood supply especially

to the cortex. Life depends on the circulation in the medulla. If the medullary nerve centers are irritated by anemia they contract the abdominal blood vessels, the blood pressure rises, and the circulation through the brain is accelerated. If, however, the splanchnic nerves are too weak to respond, one may faint or remain weak. A rise of pressure in the medulla causes the abdominal vessels to relax. Extreme congestion of the medulla, however, may cause a rise in blood pressure.

Rising suddenly to the feet after being recumbent for some time will, if there is a lack of tone in the arteries, especially the abdominal, cause dizziness or more serious symptoms. Rising suddenly may cause dizziness also in those having hypertension of the arteries or the alimentary tube, if the heart is constantly overloaded. This is because rising increases the hypertension and throws more work on the heart and it cannot pump the blood through the brain at the normal rate. Even the change in circulation caused by micturition may cause dizziness. The balance between the circulation of the skin and the interior of the body explains the beneficial effect of applying heat to the skin when internal congestions exist. Hence the benefit of sweating for congestion of the kidneys; or the application of heat in collapse or shock because the splanchnic vessels are dilated and the peripheral vessels are contracted. Whether shock is from a blow, an operation, or from purely mental shock, the patient is bled into his own abdominal vessels. This deprives the brain of blood and the vitality is lowered, or the life imperiled in proportion to the degree of anemia of the brain. Shock does not injure the vasomotor centers. As soon as the cerebral circulation is restored, normal function is reestablished.

Continued anemia of the brain or cord, however, will produce, ultimately, any degree of starvation and weakness of any nerve cells. The abdominal blood vessels are large enough to contain almost all the blood in the body; they are also the most sensitive to reflexes excited by irritation of any sensory nerves; they are therefore chiefly involved in any change of blood pressure. In all acute diseases, infectious and otherwise, the dis-

turbance is more in the vascular regulating mechanisms than in the heart. Therefore they should receive more attention. The heart is usually only the victim of circumstances. Any kind of irritation of the nervous system dilates the blood vessels of the brain. This disturbs or prevents sleep. Indigestion is a common cause. Anything which retards the general circulation irritates the brain cells in the same way. The vasomotor centers for one half of the head may be more sensitive than the other and a congestive headache may be confined to one half of the head alone.

Gravitation has a very powerful effect on the circulation. If one has hypotension, a few minutes of sitting or standing may be very prostrating, even when one could walk rapidly for a long distance with little fatigue, because exercise accelerates the circulation and overcomes to some extent the effect of gravity. Old practitioners are always hopeful of fever patients, according to Hilton, as long as they are able to turn from side to side, because this prevents or diminishes hypostatic congestions in typhoid, nephritis, etc. It is very important to turn a patient every hour or two in order to drain the blood away from congested viscera. This shows that the very restlessness of many conditions is a protective mechanism. The whole vascular system must be regarded as a vertical column of fluid. Any garments which constrict blood vessels are distinctly injurious. Treves mentions the harm produced by tight garters or low shoes which press against the ankle. Corsets, belts, and collars may be very injurious. Gravitation immediately increases the pain of ulcers of the leg. Hyperemia of any gland causes increased secretion, therefore chronic catarrh, diarrhea, gastric hyperacidity, and many other conditions are due to a similar cause—lack of constrictor tone.

A sharp blow on the skin may cause a shiver, because it produces the same contraction of the cutaneous vessels as cold. Disuse produces a diminished blood supply and therefore a lessened rate of nutrition; hence the danger of too much rest, as in the "rest cure," and the danger of weakening muscles by unnecessary supports. Breathing against resistance will stop

the pulse if the pressure in the lungs reaches a certain point. This explains the dizziness which often is produced in deep breathing.

The pulmonary blood pressure is much less than the aortic, and influences which cause a rise or fall in general blood pressure may have no effect whatever on the pulmonary circulation. This is a protection for the delicate tissues of the lungs. During digestion, because the blood vessels are dilated, absorption takes place more rapidly. Hence warm drinks are absorbed more rapidly than cold. A cold drink, if taken rapidly, may so contract the gastric blood vessels as powerfully to affect the blood pressure or the sublingual temperature. The cold drink may also powerfully contract the pylorus and produce an aggravation of any symptom by increasing gas and disturbing the circulation.

The size of the liver changes with every change in the circulation. Exercise is beneficial because it maintains the maximum circulation through all tissues and overcomes hyperemias and anemias. Deep breathing, as in connection with singing, is beneficial for the same reason.

The function of the spleen is largely controlled by the contractility of its muscular tissue. Since spinal treatment at once relaxes and contracts gastric and intestinal muscles, it is reasonable to suppose it will have the same beneficial effect on the spleen. The veins are controlled by vasomotor nerves, hence varicose veins can be cured only by strengthening the vasomotor nerves.

It may not be an unjustifiable conclusion, based on the results obtained by making vasomotor changes by spinal treatment, that the results of some surgical operations are due entirely to the great vasomotor changes produced by the operation. For example:

> The operation, *per se*, appears in some cases to have a curative effect. Thus of fifty cases of trephine (for epilepsy) in which nothing abnormal was found to account for the symptoms, twenty-five reported as cured and eighteen as improved.—Osler, in "Practice of Medicine."

Crisis and Lysis, or Active and Passive Dilatation

All are familiar with the marked change in the circulation which occurs after the crisis of an acute infectious disease. The active dilatation of the blood vessels and rapid heart action are followed by a "lysis" or drop, during which period, and less and less during convalescence, there is more or less hypotension or passive dilatation of blood vessels, or a weaker heart action. A similar change occurs in the circulation during every acute disturbance, even when the disturbance is confined to a single spinal segment. If treatment in many cases is not reversed as soon as the change in the circulation occurs, serious consequences may follow. For example, if a person, who previously had hypotension, be actively ill with tonsilitis, the blood pressure will usually be above normal and in any case the patient will require Prolonged Treatment. A single treatment may relieve the symptoms, diminish the throbbing of the arteries and bring the pulse and blood pressure to normal. A few hours later Momentary Treatment (the opposite treatment) must be given to overcome the hypotension, and if Prolonged Treatment were given it would greatly weaken the patient. If the crisis had not been passed entirely, Momentary Treatment would start up all the symptoms at once. The stronger the patient before the attack, the less danger of hypotension after. Since most people do not have hypotension, they never need Momentary Treatment. Since a patient with chronic flatulence and low blood pressure has a relaxation of blood vessels in the stomach, as soon as the acute symptoms have subsided the Momentary Treatment must be given. Sometimes, if nothing is done, the "lysis" following the acute attack will produce enormous quantities of gas, and the patient may be almost as uncomfortable as during the acute attack. The immediateness with which the Momentary Treatment must be given after the Prolonged Treatment is an exact measure of the loss of vascular tone in any area of the body. In extreme cases a few minutes' delay might increase the dilatation of the stomach, oppress the heart action, or even add to an existing

dilatation of the heart, as a result of anemia of the upper dorsal segments.

No one can possibly detect or correct these minute vascular changes in the cord or brain, unless he confines the treatment exclusively to special spinal segments; unless he considers every change even of two or three beats in the pulse, or of even 5 mm. in the blood pressure in many conditions, as well as every immediate increase or reduction in the tension of cervical, abdominal, gastric, or intestinal muscles; and, most of all, unless he recognizes as physical every explicable change in the subjective symptoms of the patient, even of the most "hysterical." For example, if one is giving Prolonged Treatment for some spinal segment, and the patient notices a sensation of pain or warmth in the scalp or bowel or foot, and the spot is controlled by the segment under treatment, it indicates that too much or too hard treatment is being given. By reversing the treatment at once, the sensation disappears and the physician avoids aggravating a condition by making a mistake which would not have made a noticeable change in the blood pressure or pulse until perhaps some time after the treatment. If any part of the abdomen becomes in the least degree more sensitive, it shows that the wrong treatment was given for the controlling half segment. Similarly any increase or decrease in the tension of any skeletal muscle will help to indicate whether the right or the wrong treatment was given. Leg muscles have relaxed at once during treatment after being contracted for as long as ten years—not, of course, if there was organic change in the cord. All of which proves that the usual anatomical viewpoint of such conditions should be abandoned for the proper physiological standpoint. It is very important to watch any change in the neck muscles when treating sensitive conditions of the eye. By having four or five tests, *i.e.*, the pulse, the blood pressure, tension of muscles, presence and immediate disappearance of gas, and the patient's sensations, by which to "check up" every move made in a treatment, each treatment can be made to have a beneficial effect on the circulation with mechanical certainty. In view of the danger of overtreating any spinal segment, and

producing an excessive or prolonged "lysis" or anemia of any segment, it follows that the use of cupping, freezing, hammering, the insertion of hat pins and all other forms of extreme counterirritation, even though beneficial for a few hours or days, will inevitably, for those with an unstable vascular system, produce excessive and undesirable consequences. This is in addition to the undesirable effects of pain. It is true the tension of the blood vessels, produced by pain, will often prevent or diminish the vascular relaxation which would otherwise follow the use of strenuous methods. This fact would explain why people are often powerfully affected by gentle but exclusively spinal treatment, whereas previously they had been little affected by the most violent general treatment.

Extreme Sensitiveness of Nerves

Incidentally the changes in the blood pressure or pulse following the least mistake in treatment are an exact measure of the sensitiveness of the vasomotor nerves in general or in any particular segment, or of the irritability of the musculomotor, visceromotor, and the cerebral cells. The weakest cells are affected by the slightest variation in the local or general circulation. It is a most obvious and valuable conclusion that there are vasomotor nerves, located in the upper dorsal segments, controlling limited vascular areas of the brain, just as there are for areas of the gums, or mucous membrane of the mouth and pharynx, or for the eyes. Whatever the cause, if there is an area of chronically low vascular tone in the gums, or mucous membrane, or retina, this local hyperemia is at once exaggerated by any slowing of the general circulation. The hyperemia may become hemorrhage and may occur with a low as well as with a high blood pressure. This increased hyperemia will be still more aggravated by too much Prolonged Treatment for the upper dorsal segments. This is partly because this Prolonged Treatment weakens the heart action, as can be observed by a blood pressure or pulse test. A chronic trouble is not cured as soon as the circulation becomes normal. Maintaining the normal circulation is the means by which the nutri-

tion of weak nerve cells is brought to normal. An acute disturbance disappears as soon as the circulation is reestablished because the nerve cells were previously normal.

Relative Tone of Blood Vessels

No one fact in regard to the circulation explains more symptoms than the following: that the blood is forced into the most relaxed vascular areas of the cord and brain by any general cooling of the surface of the body, however slight, or by any increase in the contraction of the abdominal vessels. In the condition of general hypotension, cold may force the blood into the relaxed abdominal vessels. The degree of disturbance produced depends not only on the suddenness and severity of the chill which contracts the cutaneous vessels, or the violence of the physical or mental stimulus which contracts the abdominal vessels, but also on the degree of irritability of the vasomotor nerves and the difference between the tension of the large abdominal vessels and the vessels of the cord and brain, the consequent anemia or hyperemia of the cord and brain being diminished or increased by the existing tension of the vessels in the muscles and skin. In health the changes in the cutaneous circulation are compensated for by changes in the abdominal circulation so that the blood pressure may be unchanged in the cord and brain, but the tension of the cutaneous and abdominal vessels may unite in disturbing the cerebral and spinal circulation. The fact that blood is always forced to the point of least resistance is demonstrated most strikingly in conditions of low blood pressure with some local tonic or clonic contraction as of the muscles of the neck or arm, or with neuritis of the arm. As soon as the treatment has contracted the abdominal vessels to normal, as indicated by the blood pressure reaching 120 mm. with a normal pulse, the blood vessels become hyperemic in any part of the brain or cord where the relaxation of the vessels had previously been greatest; consequently, patients who during the stage of hypotension required the most incredibly slight Momentary Treatment, or the use of alcohol, will at once, and especially after any exposure to cold, require persistent Pro-

longed Treatment for the weak segments. It is the function of the circulatory apparatus to maintain a uniform rate of flow of the blood primarily through the spinal cord and brain, but varying within limits according to the demands of the cells for oxygen and other nutrition. Any variation in this normal rate disturbs the functional activity of the nerve cells, the weakest being first disturbed.

As soon as the abdominal vessels acquire their normal tone nothing could be more marked and significant than the complete change in the kind and amount of treatment required to relieve local symptoms caused by cold. The previous low tension, with resulting anemia of the cord in the weakest vascular area, is succeeded by a period of local hyperemia of the cord which aggravates the chronic symptoms until Prolonged Treatment reduces the hyperemia to normal. People with sciatica, or other forms of neuritis, do not need to be told that the slightest cold increases the pain instantly. Gravitation, fatigue, excitement, or indigestion may do the same. It is just as true that every pathological condition, from insanity to rheumatism or a tumor, is just as certainly aggravated by cold and by the other causes which disturb the circulation, though the results usually do not appear so quickly and are then otherwise explained.

The results of air baths, cold baths, and so forth, on each individual, depend upon whether the benefit from the improvement in the general circulation which may result from the general constriction of the blood vessels normally excited by cold on the skin, will exceed the harm done to the local vascular area which is pathologically weak. Accelerating the general circulation always strengthens the vasomotor nerve cells controlling the circulation in any weak area and, for this reason, may overcome any temporary increase in the local hyperemia produced by the contraction of the cutaneous vessels.

Extreme cases of hypotension or of high blood pressure are least likely to be benefited or most likely to be injured by such cold air or water treatment, but the relative tone of vessels in the different areas is a deciding factor. Such changes in the local blood pressure in the weakest areas of the cord and brain

occur with mechanical certainty, in accordance with the vascular changes in the abdominal and cutaneous circulation, and are a most striking confirmation (unexpected by the writer) of the principles underlying spinal treatment. It also proves that the normal blood pressure is always 120 or 121 mm., although this is usually obscured because of high tension in some vascular areas and low tension in others. When the arterial tension is normal in every part of the body the blood pressure is 120 mm. in the arm.

The differences in vascular tone in different parts of the body explain various apparently contradictory effects of heat, cold, altitude, and a great variety of "ideopathic" conditions. For example: a general condition of high tension is less dangerous or made more endurable—or perhaps, if not extreme, more benefited—by a low altitude or warm weather or warm baths, than by cold air, cold baths, or a high altitude. If, however, the vascular tone of the head is poor, the local relaxation of the cerebral blood vessels, caused by the low altitude or hot weather or baths, will outweigh the effect of a high altitude or cooler air or baths. High blood pressure with local areas of low tension are the most serious. Obviously, if some blood vessels are relaxed and some contracted, attempts to restore the normal circulation in every part of the body by *general* treatments, whether hydropathic, manual, electrical, or by any combination of drugs, may be quite inadequate.

Since the contractions and dilatations of arteries in every tissue in the body are controlled by vasomotor centers in the brain and cord, it is a far more fundamental and effective therapeutic proceeding to correct the anemia or hyperemia which may exist in any spinal segment and so enable all the vasomotor nerves to resume their normal functional activity, than to attempt by hydropathic, electrical, medical, or mechanical means to control the vascular changes in the rest of the body, all of which vascular changes are dependent for their relief on the condition of the vasomotor cells in the cord. It is obvious that if there is a general anemia of the cord or brain from abdominal hypotension, any general proceeding which contracts the abdominal

vessels will relieve the anemia of the cord and brain. Also if the brain is hyperemic from contractions (hypertension) of abdominal vessels, whatever general treatment dilates the abdominal vessels will relieve the cerebral hyperemia. However, a perfectly uniform arterial tone rarely exists, therefore *each* spinal segment should be properly and perhaps separately treated if the arterial tone is ever to be made uniform, and even general hypertension or hypotension can be best controlled by spinal treatment.

Objective Illustration of Changes in a Congested Area

If one has a congested eye from cold, and the nervous system is sensitive, the following facts in regard to the circulation will be observed, and these circulatory changes which can be seen or felt in the eye are just as true, with a few qualifications, if the hyperemia is in the brain, lungs, stomach, kidneys, or any nerve (and called neuralgia or neuritis) or any other tissue. The laws are just as true of any part of the body, no matter what name we give to the disease, or whether the condition is curable or incurable. The amount and rapidity of recovery depend, however, on the circulation. The pain, redness, and throbbing will be least when the whole body is comfortably warm. A sudden change from a warm air to a cooler will instantly increase the pain, redness, and throbbing, because the external blood vessels contract and force the blood into the dilated area. Local application of cold will diminish the disturbance unless the nerves are so generally sensitive that the local application produces general effects on the circulation.

If the hyperemia is not extreme and the nerves in the skin are not too irritable, and the change to cool air is not too sudden, the hyperemia is diminished by general contraction of the blood vessels. Heat, which dilates all the blood vessels of the body, immediately increases the local throbbing. Gravitation has a powerful effect on the local hyperemia, depending on the location of the area, the position of the body, and the weakness of the nerves controlling the local circulation. If the blood pressure is low from lack of tone in the abdominal blood vessels,

gravitation will produce much more disturbance than if the blood pressure is normal or above. Use of any organ increases the amount of blood necessarily required to carry on its functions. Any increase of heart action from exercise, heat, or excitement will increase the local throbbing.

The changes produced by cold are the most frequent, extreme, and difficult to control, especially if the nerve cells in the brain or spinal cord have become exquisitely irritable from fatigue, illness or starvation (from lack of food, sleep, or a poor circulation). Many chronic conditions which fail to improve or become worse are entirely the result of constant aggravations of the local circulatory disturbance, by temperature changes. Cold commonly determines the ultimate limit of life of the animal organism.

The local congestion or hyperemia may be in some area of the spinal cord or brain and the resulting symptom will be observed at the peripheral end of the affected nerves. The symptoms may be purely "nervous," but any symptom, even the growth of a tumor, will be increased by any additional disturbance of the circulation, either in the spinal cord, brain, or the area more obviously affected. If the local congestion is in the eye and the general health good, the proper kind and amount of pressure, heat, or counterirritation on the spinal muscles (over the posterior primary divisions of the spinal nerves) will rapidly relieve the pain and throbbing. If the wrong kind or amount of treatment is given, it will immediately aggravate the disturbance. If the local hyperemia has been long continued the relief produced by treatment will continue only a short time because the lack of tone of the local blood vessels is so poor (or to be more exact, the controlling vasomotor nerve cells are so weak) that the blood will be forced into the dilated vessels by any of the causes previously discussed. But by repeating the spinal application which restores the normal circulation to that part of the spinal cord which controls the eye, the vasomotor nerves will become stronger as a result of their improved rate of nutrition.

As the nutrition and, therefore, the strength of these vaso-

motor nerve cells improve, they are more and more able to maintain a sufficient contraction of the blood vessels in the eye and the redness, pain, and throbbing disappear. If the congestion is recent and not extreme, a single treatment may produce a permanent cure. If a chronic condition, the relief from each treatment will continue for a longer and longer period. The result depends on the weakness of the controlling nerve cells.

Opposite Effects of Heat and Cold

The following quotation from Lauder-Brunton will explain some of the apparently contradictory results of local applications of heat and cold:

> We may modify the local circulation in inflammation either by heat or cold. If the inflammation be situated in a place where the tissues are yielding, heat frequently relieves it most, but if the tissues are unyielding, as, for example, when the inflammation occurs at the root of a tooth or under a hard fascia, heat increases the pain while cold relieves it. The explanation of this is obvious. Heat tends to cause local dilatation of the vessels, and if the nerves which run alongside them are in an unyielding sheath, the dilated vessels press upon them and increase the pain; whereas if the tissues are yielding all around, the collateral circulation is increased, and the pressure of blood in the inflamed area is lessened. If the nerves and vessels are both confined in an unyielding sheath, the application of cold tends to cause contraction of the vessels, and, by diminishing their caliber, to lessen pressure upon the nerves and ease the pain. The local application of heat may produce a pretty extensive dilatation of the vessels: for, on putting my feet into a bath of hot water, I have sometimes observed increased pulsation of the femoral arteries. The local application of cold in the case of an artery will cause it to contract, and lessen the circulation in the distal part, so that if a cold bandage be applied over the middle of the arm, the radial artery will beat less strongly. P. 74.

Some other apparently contradictory results obtained from the use of hot and cold applications may be explained in part by the following facts: Very hot applications have the same effect as cold, *i.e.*, constrict the blood vessels. The first effect of moderate heat is to dilate the blood vessels. Moderate heat, if very long continued, has the same effect as cold, *i.e.*, constricts the

blood vessels, as in the hands of a washerwoman who has been working with hot water for several hours.

Cold first constricts, then dilates, and finally again constricts the blood vessels. *Prolonged* application of ice paralyzes the vasoconstrictor nerves and causes dilatation of the blood vessels.

To explain why sometimes hot applications and sometimes cold are prescribed for inflammation of internal organs, it should be remembered that moderately hot applications draw the blood to the surface and therefore sometimes relieve the internal congestion, whereas applications of ice constrict both the superficial and deep arteries, thereby relieving internal congestion. Ice is thus used for appendicitis and hemorrhage of the lungs. For debilitated patients the prolonged use of cold depresses the vitality of the whole organism. While a hot water bag on the stomach relieves pain somewhat, it has much more effect placed on the spine, because it affects the controlling nervous mechanisms.

If pain in the throat is due to contraction of muscles from excessive irritability of the controlling nerve cells, a cold gargle or ice water may increase the contraction; whereas warm water would relax the contracting muscles. If the pain or soreness is due to a hyperemia or congestion of the mucous membrane, a cold gargle, or dissolving ice in the mouth, would be beneficial because it would contract the dilated blood vessels; whereas a hot gargle or drink would not. For acute laryngitis, use iced compresses or an ice bag to allay the swelling and inflammation of the throat, because hot compresses might aggravate acute laryngitis. When using salt water for a gargle or an eyewash, use the normal salt solution (a level teaspoonful to a glass of water); too much or too little salt may irritate the tissues by osmosis.

PART 6

Warnings

1. *Watch the Blood Pressure*

Never lower the blood pressures below normal (120 and 80

mm.). Anemia is the greatest irritant to nerve cells and as the blood pressure falls below normal, there will be an increasing irritability of the whole nervous system, manifested by the weakest centers first. This anemia may produce only a heavy feeling in some part of the abdomen, especially if the patient has had some chronic weakness of the abdominal blood vessels, following an operation, gastritis, or peritonitis; it may produce dizziness, faintness, or palpitation of the heart and aggravate any symptom, even producing the most violent anemic headache or severe cramp in any voluntary or involuntary muscles. The cramp may be anywhere from the muscles of the larynx or the appendix to those of the foot, wherever the nerves are most irritable. If the blood pressure falls below normal it may make any symptom, even rheumatic swellings or arthritis, worse, and could produce a hemorrhage on the brain or retina. It is of primary importance to determine before treatment whether a low blood pressure is due to weak heart action with hypertension of the arteries or visceral muscles (see Summary of Conditions of the Circulation), or to hypotension of the arteries.

It is just as important to watch the blood pressure if it is above normal. If the blood pressure is high, Momentary Treatment may cause a dangerous rise in blood pressure. The slightest pain or even unconscious irritation of nerves will cause a rise in pressure as per Warning 2.

Temporary rises in blood pressure from increased heart action or moderate excitement subside as soon as the heart action quiets down, but variations in blood pressure produced by spinal treatment are far more powerful and persistent, and, if the treatment is improperly done, are serious for the weak. These facts should prove the danger of routine, manual, hydropathic, and electric treatments, without proper tests after each treatment.

If the heart action is considerably depressed from abdominal resistance it is necessary to relieve the resistance before very much can be done to restore the normal blood supply to some particular segment. Very often the first effect of giving Prolonged Treatment for the abdomen in this condition, which may

be the result of cold, or of chronic fatigue, is a rise in pressure with an apparently greater sensitiveness and increase in size of contracted spinal and intestinal muscles, followed by an entire disappearance of the sensitiveness and contraction as the treatment is continued.

Frequently one can feel a section of the intestine which was painfully contracted before treatment gradually become more prominent until, as the treatment is continued, it entirely relaxes, and the incarcerated gas moves on. This may require from one to thirty minutes' (sometimes much longer) steady pressure and gentle massage over a particular segment, because the pressure of the gas is constantly exciting the reflex of contraction. By going to the seashore a man with low blood pressure from abdominal hypotension may be quite prostrated, sometimes with cramps, from the additional fall in blood pressure. Alcohol for the right segments will contract the relaxed arteries, relieving, sometimes instantly, the abdominal cramps or other symptoms which are produced by anemia of the brain and cord.

The most powerful vasomotor mechanisms are located in the lower dorsal segments, and these produce the greatest variations in general blood pressure. These powerful splanchnic centers may be thrown into violent activity by any mental excitement, any pain, or irritation of any nerve from external pressure or blow (traumatism) or from any internal disturbance, as from dysmenorrhea. Consequently, to relieve any acute condition these segments must receive primary and appropriate treatment, if one expects to readjust the general normal vascular conditions.

A reflex excited by cold, excitement (as a fright), or indigestion, *e.g.*, a cramping or contraction of spinal or gastric or intestinal or arterial muscle fibers, may persist after the immediate cause has disappeared. This persistance is the result of the vasomotor changes produced in the cord by the excitement, cold, or indigestion; and just so long as the vasomotor disturbance continues, the functional disturbance of the nerve cells in these segments will continue or increase. The feeling of de-

bility which follows a great variety of acute attacks is often due to the persistence of contraction or dilatation of splanchnic blood vessels caused by the pain of the attack. Proper treatment gives relief, and overcomes the prostrating effect of diarrhea, grippe, and other infections and the effects of "delayed shock" from operations.

2. *Never Cause Pain*

Pain produces powerful changes in the circulation. Even when the patient feels no pain, the vasomotor nerves may be irritated and any symptom aggravated. The importance of this fact cannot be overestimated. If a foot bath is too hot, the pain may dilate the blood vessels of the head and increase instead of relieve a headache. Pain, even from the irritation of the brain from a mental shock, usually first raises the blood pressure, followed in many people by an immediate fall, and very quickly if the patient is weak. Producing pain by pressure over any sensitive spinal nerves may contract instead of relax the intestinal, arterial, and abdominal muscles. If Prolonged Treatment is required and the nerves are very sensitive, the mere warmth of the hand through the clothing, with no pressure, may be sufficient to produce beneficial and powerful changes in the blood pressure, but the least pain will at once counteract these beneficial results. A difference of one ounce pressure may determine whether a treatment will entirely relieve or aggravate headache, nausea, neuralgia, or other acute attack.

If the skin or spinal muscles are extremely sensitive, a warm compress four or five inches wide may be applied to the whole length of the spine for half an hour, or several hours if necessary. Cover the compress with a dry, warm blanket and place a comfortably hot water bottle against these coverings to maintain a steady heat. Avoid overheating the whole body and so accelerating the heart action. It will produce results obtained by Prolonged Treatment when the back is too sensitive to endure any pressure. Prolonged Treatment with the hand can often be given immediately after even a brief application of this compress. If the nerves are sensitive, the bag should be only

comfortably warm; if too hot, it could add to the disturbance and make large amounts of gas by dilating the gastric blood vessels. Some patients are exquisitely sensitive to heat and require pressure.

If the patient's spine is very sensitive, in giving Prolonged Treatment apply the fingers to the back very gradually, so as not to cause the irritable muscles and blood vessels to contract suddenly, thus causing needless pain and the undesired effect of Momentary Treatment.

In some patients, the motor nerves (musculomotor and visceromotor) are irritable; in others, only the sensory nerves. The first class may require very hard pressure, but if the sensory nerves are very irritable, only the lightest possible treatment can be given even if the patient is very strong and muscular. The strongest men have sometimes the most irritable nerves.

Since pain produces undesirable results, for many people the use of vibrators and other forcible methods is precluded. But even when no pain is produced, the vasomotor nerves may easily be irritated incredibly and vasomotor disturbances produced; or very light pressure may irritate the musculomotor nerves in arthritis and increase the stiffness, without causing pain.

If one spot in the spinal muscles is exquisitely sensitive, one hand should be held over this spot, while the other is treating the rest of the spine. Afterward the sensitive spot can usually be gently manipulated.

The amount of effect produced on any part of the nervous system by a change in blood supply depends on the irritability of the nerves to be affected. If the nerves to the heart in the upper dorsal segment are very irritable, the number and strength of pulse beats may be increased or diminished by the most insignificant amount of Prolonged or Momentary Treatment. Although steady pressure across occipital nerves is sometimes very quieting to some patients, occasionally the tissues at the back of the neck are so sensitive that any pressure will excite

the oversensitive dilators and increase the soreness for some hours.

The response to any treatment is in proportion to the irritability of the nerve centers. If the spine is irritated, as by a spinal jacket or corset, use some soothing application, as a warm compress with or without olive oil, because Prolonged Treatment could not be given. In many acute conditions, as lumbago, heavy continuous pressure may feel agreeable even to patients who ordinarily could endure hardly any pressure. If the patient is very muscular, with tensely contracted muscles, it may be necessary in treating an acute attack to press extremely hard. Sometimes, however, the vasomotor nerves may be so exquisitely sensitive that the lightest pressure on the spinal muscles will make the skin sensitive or the muscles ache for several days. Such a disturbance would be quickly relieved by the use of the warm water bag or alcohol, according as there is hypotension or hypertension of the abdominal vessels.

3. *Be Most Careful in the Use of Cold*

The response to a stimulus depends as much on the irritability of the nervous system as on the violence of the stimulus, *e.g.*, a few drops of cold water on any part of the skin of sensitive patients may cause a violent contraction of the cutaneous vessels with great rise of blood pressure and aggravation of existing symptoms. In a critical condition, cold might be fatal. This is quite as true of pain from too hard pressure. It is a dangerous and thoughtless practice to blame unexpected results from a treatment to hysteria. If the spinal muscles are very sensitive and cramp when touched, apply the whole hand carefully and steadily against, and parallel to, the back when giving Prolonged Treatment. A cold hand would counteract the effect of the steady pressure. If the spine is too sensitive, have compress applied as per Warning 2.

The application of ice to the skin produces first a contraction of the blood vessels, and later, if too prolonged, a dilatation of the vessels. Cold may have also a depressing effect on the whole organism.

4. *Protect the Spine*

Patients should be cautioned to protect themselves against draughts and other exposures to sudden cold, especially during a course of treatment; otherwise cold, causing exacerbations of every trouble, will entail the loss of much valuable time. In winter, for those in Class 2, 3, or 4, it may be best to wear a piece of flannel over the spine or, at least, to put a piece of newspaper under the coat after every Prolonged Treatment, because the slightest degree of cold after such a treatment, which dilates the vessels of the spinal muscles, might powerfully contract those same blood vessels.

Many people imagine that they are not affected by cold air because they rarely have a cold in the head, but a cold in the head is only one of the results of the changes in circulation produced by exposure. Cold may aggravate any symptom whatever. This is not a theory but a physiological law, which will be demonstrated in a few days on most patients. Not until sensitive patients learn this law can steady progress be made. When the nervous system is uniformly strong, one can by cool bathing, the cold air bath, and exercise increase the resistance to cold, but as long as there is a weak point, any cold will force the blood into the weakest area. One has only as much resistance as the weakest area and that may be as sensitive as a baby's. Cool air is very beneficial for hypotension, if the temperature changes are not too sudden.

Most people realize that after a hot bath, or a treatment by means of any hot application, or even after wearing a plaster on the skin, there is danger of taking cold, unless cold water or alcohol is applied to the skin. Otherwise the least cool air may suddenly and powerfully contract the blood vessels of the skin which had been dilated by the heat, and any degree of congestion or any other trouble may be produced in any tissue of the body.

This law is just as true after a Prolonged Treatment over any area of the spine, but unfortunately the application of cold water or alcohol to the spine would instantly destroy all effects produced by the treatment. Therefore, the spine must be pro-

tected continuously all the time treatment is being given, not only to avoid colds in the popular sense of the word, but also to avoid losing all effect of the spinal treatment. Many chronic troubles are simply the result of incessant exposure of too sensitive areas. The application of capsicum and vaseline to the back protects the spine from cold to some extent, as well as having the effect of Prolonged Treatment.

In some people the vasomotor nerves to part or all of the back are so irritable as to maintain a constant contraction of the cutaneous vessels, so that the skin feels cold all the time and shivers are felt from the slightest lowering of the temperature. In such conditions unless the patient wears some woolen cloth or cotton batting on the spine, under or over the underwear, until the normal balance of the circulation is reestablished, the effect of any treatment may be lost in a few minutes. It may be necessary to wear the extra protection only a few days, if the patient is helping to reduce the irritability of the nerves by resting. Without this protection, every shiver brings back the former hyperemia of the spinal cord, which was the cause of the persistence of the chronic trouble.

5. *Effects of Treatment Are Not Mental*

It is a serious mistake to attribute the results of spinal treatment to psychic impressions. Treatment produces its effects on the circulation without regard to the mental attitude of patient or operator, just as gravitation produces its effects on the circulation and on all substances in nature. Undoubtedly, hope, interest, and confidence may sometimes greatly improve the circulation, and irritation would disturb it, but those who depend on this factor alone can never do any exact physiological work; especially on those patients who have disturbances in certain segments only. The fact that one kind of treatment given to one side of the spine will relax painful intestinal contractions, whereas the opposite treatment given to the other side will increase at once the tension of the contractions in the other half of the abdomen, and that these relaxations and contractions can be reversed at will by opposite treatment, ought

to prove the folly of depending on the mental effect of treatment. Many similar illustrations may be given to show that these results are independent of the mental attitude of either patient or doctor and the results will be quite contrary to the expectations of both if a mistake is made. If a cold is just beginning, but not yet apparent, or if the patient neglects to mention some acute condition, as a slight headache, neuralgia, rheumatism in some muscle, or diarrhea, and the wrong treatment is given, these conditions will be immediately aggravated.

Fortunately the effect of any wrong treatment can be instantly reversed. Often the amount of treatment required to produce the most beneficial results on the circulation is distinctly disappointing to patients who expected some general manipulation. The extreme care, as indicated by the "Warnings," required to affect the circulation accurately, shows that one could not depend in any degree upon mental suggestion.

6. *Treat the General Circulatory Disturbance First*

In treating any acute attack, one should aim first, to bring the general circulation to normal, before attempting to relieve any local cramp or congestion by treating particular segments. Local attacks, as of rheumatism in certain muscles, neuritis, asthma, headache, etc., are very frequently the result of a general cold which affects the weaker points chiefly, and the general vasomotor disturbance must be readjusted before much can be done for particular vasomotor mechanism.

Always give the most important part of the treatment first. If the blood pressure is high and the stomach distended with gas, first liberate and diminish the secretion of the gas, by Prolonged Treatment over stomach segments, and do not give general Prolonged Treatment for the whole lower dorsal and lumbar region until you know whether the gas in the stomach was alone responsible for the high blood pressure. After the stomach only is treated the blood pressure might return to normal and Prolonged Treatment for the other dorsal and lumbar segments would be unnecessary and injurious. The soreness and tension of the spinal muscles is, of course, another

guide. The neck muscles which are controlled by the fourth to sixth dorsal segments, relax and contract according as the right or wrong treatment is given and the same treatment will affect the stomach simultaneously, either rightly or wrongly.

7. Great care must be exercised in treating the sacral segments, because they control the contractions of the intestinal muscles and blood vessels in the lower part of the abdomen. If a patient requires general Momentary Treatment, but happens to have, as the result of cold, some hyperemia of the sacral segments only, Momentary Treatment over the sacral segments may immediately cause contraction or cramps of the intestinal muscles, in the lower half of the abdomen. This hinders the movement of the gas into the lower bowels where it is reabsorbed. This resulting incarceration of gas will depress the circulation and may cause a great variety of symptoms. Prolonged Treatment over these same sacral segments will at once relieve these symptoms.

8. *Emboli*

Never manipulate tubercular or infected glands for fear of spreading the infection; also give no local treatment for phlebitis for fear of causing emboli.

9. *Simultaneous and Opposite Results.*

Always bear in mind the separate and sometimes apparently, though not actually, opposite effects, which are produced simultaneously on the vasomotor and visceromotor nerve centers situated in the same spinal segment, by treatment of that segment.

10. *Do Not Draw Hasty Conclusions*

When the blood pressure is nearly or just normal, or if the pressure of large amounts of gas is disturbing the blood pressure, it is often very difficult to decide for the first time which treatment is required for each part of the cord. It may be necessary, for example, to wait several minutes or much longer, after treating the middle third only, before one can be sure the correct treatment has been given.

If one has low blood pressure, Prolonged Treatment for the middle third may relax the stomach and intestines and allow

the gas to move along and be reabsorbed, the pulse may be better, and the abdominal muscles and intestines may feel soft and relaxed; but if hypotension exists, the gas will rapidly refill the bowels and a few hours later the patient will be much worse. If the low blood pressure is due to hypertension of the intestines, alcohol for the middle third may make the pulse stronger for a while because the heart will beat more heavily in its effort to pump the blood against the increased abdominal resistance, but afterward the heart action will weaken and all symptoms will be worse.

If the abdomen is full of gas or one is suffering from any abdominal pain, it is important to treat the second to fifth dorsal segments to diminish the formation of gas. Sometimes the most severe *abdominal* distress is entirely relieved by treating these segments, and treatment to relax the cramped intestines gives only temporary relief because enormous quantities of gas are passing from the stomach and the gas immediately refills this contracted part of the intestine.

Sometimes both Momentary and Prolonged Treatment will make the abdomen more sensitive for a few minutes, even when properly given, but after a few minutes the sensitiveness subsides and all the tests show improvement. When Momentary Treatment causes this increased sensitiveness it is because the sudden contraction of the intestines produced by the alcohol holds the gas more tightly in the intestines for a few minutes. When Prolonged Treatment, correctly given, increases the abdominal sensitiveness, it is because the irritability of the nerves is so great that the lightest possible pressure of the hand against the spine will temporarily increase even the irritability of the visceromotor nerves. In a few minutes the abdomen will be less sensitive than before treatment, if the proper treatment is given.

11. *Electrical Treatment*

If one wishes to use electrical apparatus to affect the circulation, in addition to the precautions mentioned in books on electrotherapy, attention is called to the following:

If a patient has abdominal hypotension (Class 1 or 2) any general vasodilating effect is injurious even if the patient feels temporarily better after each treatment. Even a local vasodilating effect may be very injurious for people in Class 1.

If a patient is in Class 3 or 4 (hypertension) any general vasoconstricting effect will be injurious. The slightest irritation of the skin by any emanation treatment may cause a dangerous rise in one with high blood pressure. The general condition must not be sacrificed for a local one.

X-rays produce valuable vasoconstricting effects on local hyperemic or hemorrhagic areas but if continued to the point of exhausting the vasoconstrictor nerves, they may increase the hyperemia and cause congestion or burns. After an electrical treatment has produced a general relaxation in those with hypertension, it must be followed by digital treatment of remaining contractions of spinal muscles, if one expects to bring any weak segments back to normal.

PART 7

Some Instructive Facts about Musculomotor and Visceromotor Nerves, and about Muscles and Lymph

Hilton has called attention to a very interesting and instructive fact in regard to the associated distribution of arteries and nerves. For example, the soft palate receives six arteries, three on a side: one from the facial artery in relation to respiration; one from the ascending pharyngeal artery in relation to deglutition; one from the internal maxillary artery in relation to mastication. He has also called attention to the fact that the same nerves which supply the mucous membrane supply also the muscular apparatus acting upon that membrane. This explains why narcotic applications to the mucous membranes may quiet a cough or an asthmatic attack; though of course depressant drugs ultimately increase irritability of nerves.

While it is of primary importance for therapeutic purposes to know the spinal segment from which nerve fibers start, the following anatomical generalization of Hilton is instructive, *viz.*, that the same nerve trunks whose branches control the

muscles moving a joint also send nerves to the skin over the insertions of these muscles, and also send nerves to the interior of the joint. In addition to other considerations, this acts as a protective mechanism whenever the point is inflamed, because the irritation of the nerves in the interior of the joint will stiffen the muscles which move the joint and thereby insure necessary rest. If muscles are stiff from inflammation exercise is injurious, otherwise it is beneficial. Abdominal muscles contract over an inflamed organ for the same reason, and the secretion of lymph surrounds and gives rest to the injured part.

Hilton has also observed that nerves enter muscles where they are most protected from pressure. For example, the phrenic nerves, on which respiration and life depend, have their terminal filaments distributed on the under surface of the diaphragm. This protects them from pressure by the lungs, and gravitation prevents the abdominal viscera from pressing against them. It is this action of gravitation which explains the relief afforded by a sitting posture to one breathing with difficulty.

Irritation of one branch of a nerve may disturb the function of other branches of the nerve; *e.g.*, a rough tooth scratching the tongue has been known to cause an abscess in the ear, according to Hilton. Irritation of the periphery of a nerve may irritate any or all nerve cells located in the same spinal segment; *e.g.*, ovarian disturbance may cause pain in the knee, or any internal disturbance affect spinal muscles innervated from the same spinal segment. Snuff may cause the eyes to water because it stimulates the nasal branches of the ophthalmic nerve. Decay of the teeth may cause pain in the side of the face and neck.

Strong irritation of a sensory nerve suppresses reflex movement. For example, inhibition of sneezing by friction of the nose; inhibition of the movements usually elicited by tickling, by biting the tongue. . . .

In some cases, further, it appears to be sufficient to inhibit a reflex, to concentrate the attention on the execution of such a complicated reflex movement in order to prevent it. Some persons, *e.g.*, are unable to sneeze if they think intently of the motor processes concerned; as the will, in a measure, prematurely begins to control the reflex centers

by the thought, the normal course of the reflex excitation for the stimulus from the periphery is interfered with.—Landois, pp. 731, 732.

Acute peritonitis—The stimulation of afferent nerve fibers in the peritoneum is such that abdominal movements connected with respiration are completely inhibited; when pain is relieved by administration of opium in large doses, though the peritonitis itself is unaltered, the abdominal respiratory movements reappear.—Landois.

This is an illustration of how drugs may mask symptoms.

According to Oddi the common bile duct is provided with a sphincter at its duodenal orifice, which is affected by reflex influences; gastro-intestinal irritation is believed to cause spastic contraction, which would not be unimportant in the explanation of attacks of jaundice of nervous origin.—Landois, p. 934.

Any source of irritation of the nervous system may cause such cramps in any muscle innervated by irritable nerves.

All kinds of irritation, mechanical, thermal, chemical, electrical, and somatic (inflammatory processes, disturbance of nutrition, and the like) may excite pain.

Pain will increase the irritability of all nerves. Pain is usually referred to the periphery of the nerve.

(Pfluger's twitch law.) "Small stimuli fan the activity of life, medium large ones further it, strong ones impede it, strongest destroy it."

For diseased organs, stimuli may be strong when they can scarcely be considered as such for healthy organs.—August Bier.

The more irritable the nerve the greater the response to stimuli, hence the need of greatest care in all therapeutics, whether medical or mechanical.

We can never say in advance how long and how intensely a mustard plaster, for instance, will affect a given individual.—Bier.

This shows the importance of considering all the Warnings, in treating sensitive patients, because one may meet any degree of nervous irritability and treatment must be regulated accordingly.

Lymph

The following facts may serve to call attention to the rôle of the lymph in supplying the nutrition to, and carrying the waste products away from, every tissue of the body.

Although local manipulations would be often a valuable aid in reducing accumulations of lymph (see Wharton Hood on Treatment of Sprains, Treves, p. 567, and any book on massage), the writer has confined himself to treatment of the spine, because if spinal treatment alone can reduce obvious accumulations of fluid, it proves the possibility of controlling the circulation in organs and tissues inside the body. The blood which flows through the arteries and arterioles finally enters the network of capillaries. Through the walls of the capillaries filters the colorless part of the blood, called lymph. The lymph flows around the individual cells of a tissue, so that each cell may be compared to a fish living in a stream of salt fluid from which it takes its nourishment and into which it discharges its waste products. The lymphatics are the vessels which convey the lymph back toward the heart. The beginnings of the lymphatics are, therefore, channels through which nutrient fluid is conveyed to the tissues. In some tissues, as in the glands, *e.g.*, the salivary, the lymph spaces are reservoirs from which the gland receives its fluid. In addition the lymphatics are the drainage system for all tissues.

When a tissue requires lymph to supply the materials needed for increased activity of the cells, the blood vessels in that area dilate and to this extent, therefore, the secretion of lymph is controlled by the vasomotor nerves. Pressure on veins and lymphatics causes an accumulation of lymph in a tissue, and interferes with its nutrition. This explains the bad effects which may result from tight collars, corsets, belts, garters, and shoes. Soreness of feet is often the result of a gradual accumulation of lymph from pressure, even of low shoes, on the vessels below the internal malleolus.

Lymph is moved along the lymphatic vessel chiefly by the muscular contraction of the parts in which the lymphatics lie. This shows the absolute need of exercise and the benefit of

massaging muscles. Respiration also has a powerful effect on the movement of lymph. This explains the beneficial effect of deep breathing, physical culture, and vocal exercises. The lymphatic glands are enlargements of the lymphatic vessels and appear to act as filters, which remove foreign substances from the lymph.

Lymph is a protective fluid. According to Lazarus-Barlow, an infection, like the pneumococcus, irritates the membrane, causing an hyperemia, with resulting exudation of lymph which kills the micro-organism and neutralizes its poison. It is therefore, according to many writers, the lymphatics of the mucous membrane of the nose, larynx, pharynx, and bronchi, and especially those of the adenoids and tonsils, which are our chief defense against the numerous infections which find entrance into the respiratory tract. Hence the value of antiseptic gargles and perhaps greater caution in removing adenoids, tonsils, and other parts of the mucous membranes.

According also to Lazarus-Barlow, the exudations which are passed out into the bronchi after an irritating gas has been inhaled, protect the epithelium from further action of the gas. According to the same writer, the walls of an acute abscess really constitute a barrier against the extension of the irritant which called forth the inflammation. Hence the ever present risk of spreading infection by lancing an abscess.

The Arterio or Vasomotor and Visceromotor Neural Cells

J. P. Arnold

The vasoconstrictor neural cells for the brain, face, scalp, eye, ear, mucous membrane of the nose, mouth, pharynx, tonsils, larynx, and salivary glands are found in the second to the fourth dorsal segments.

Esophagus and stomach, 4th-9th dorsal segments.
Diaphragm, 3d-6th dorsal segments.
Lungs and bronchi, 3d-7th dorsal segments.
Appendix, 10th-12th dorsal segments (only on right side).
Gall bladder, 9th-12th dorsal segments (on right side).

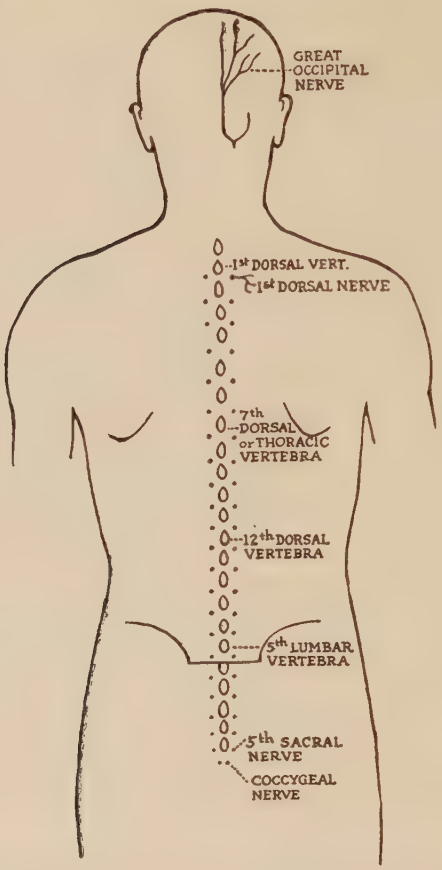


Diagram to illustrate that a spinal nerve is named from the vertebra above its point of exit from the spinal column.

Coronary arteries, 7th cervical-2d dorsal.
Liver, 6th dorsal-1st lumbar.
Chiefly 10th-12th dorsal segments.
Pancreas, spleen, and suprarenals, 8th-12th dorsal segments.
Arms, 4th-6th dorsal segments.
Cervical cord, 2d-4th dorsal segments.
Kidneys, 4th dorsal-2d lumbar.
Small intestines, 6th dorsal-2d lumbar.
Large intestines, 6th dorsal-2d lumbar.
Bladder, ext. org. gen. uterus, Fallopian tubes, ovaries, prostate gland, 11th dorsal-2d lumbar.
(Occasionally 3d-4th lumbar.)

Sigmoid flexure, 2d-4th lumbar segments.
Exter. sphincter, 3d-4th lumbar segments.
Legs, 2d-5th lumbar segments.
Skin and muscles of trunk, 2d dorsal-2d lumbar.
Blood vessels of cord, throughout entire cord.

Viscero-inhibiting or Constricting

Pupil, nucleus of 3d cranial nerve.
Bronchi and branchioles, nucleus of 10th cranial nerve.
Heart depressors, 10th-11th cranial nerve.
Spleen, 4th-10th dorsal.
Esophagus, 5th-8th dorsal.
Stomach and small intestines, 4th-9th dorsal.
Sigmoid flexure and large intestines, 10th dorsal-4th lumbar.
Cells which inhibit muscular coat of Fallopian tubes, uterus, with contraction of the cervix uteri, etc., 2d, 3d, 4th lumbar.
Cells which inhibit muscular coat of bladder and rectum and contract sphincter of bladder and anus, 2d, 3d, 4th lumbar.
Neural cells for external sphincter ani are in 5th sacral and coccygeal.

Vasodilator Neural Cells

The vasodilator neural cells for the brain, 2d-3d dorsal.
Cervical cord, 2d-4th dorsal.
Face and scalp, nucleus of 7th and 9th cranial nerves.
Eye, nucleus of 5th cranial nerve.
Submaxillary and sublingual glands, ear, mucous membrane of nose, hard and soft palates, upper lip and gum, nucleus of 7th cranial nerve.
Floor of mouth, lower lip, mucous membrane of cheeks, lower gums, tongue, parotid gland, nucleus of 9th nerve.
Pharynx, larynx, and tonsils, 9th-10th cranial nerves.
Diaphragm, phrenic nerve.
Lungs and bronchi, 3d-7th dorsal.
Arms, 4th-6th dorsal.
Esophagus, stomach, small intestines, liver, kidneys, suprarenals, pancreas, coronary arteries, spleen, and first half of large intestine, nucleus of 10th cranial nerve.
Appendix, 10th-12th dorsal and 10th cranial nerve.
Gall bladder, 9th-12th dorsal and 10th cranial nerve.
Fallopian tubes, uterus, ovaries, 3d-5th sacral.
Bladder, ext. organs gen., 3d-4th sacral.
Sigmoid flexure and rectum, 1st-4th sacral.
There are *additional* dilators to the stomach, 3d-9th dorsal.

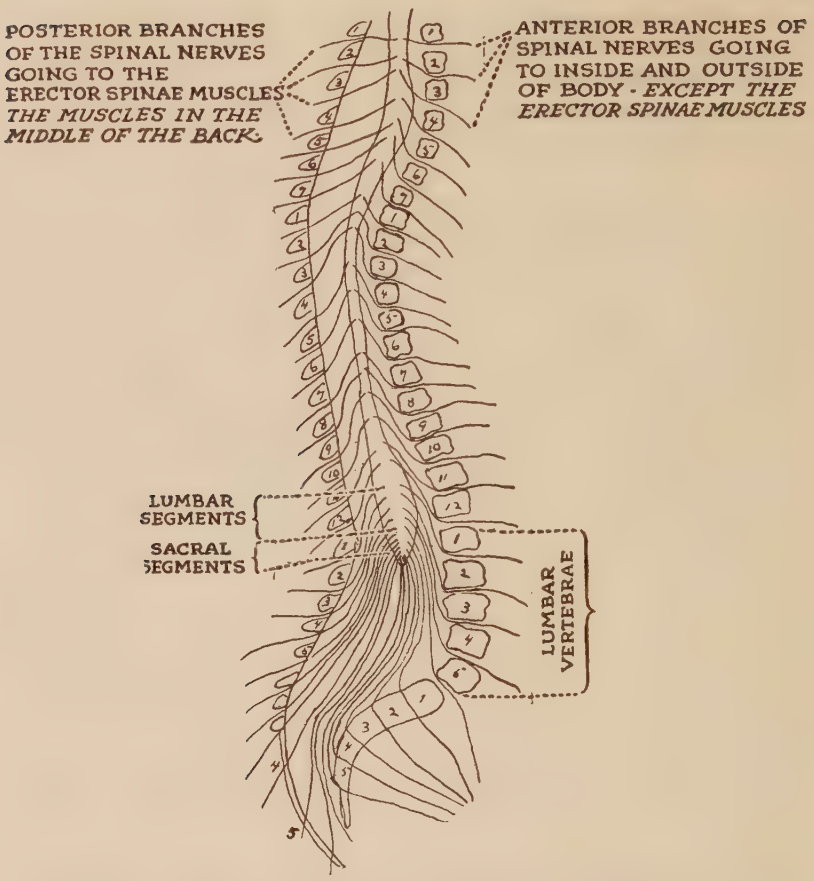

POSTERIOR BRANCHES OF THE SPINAL NERVES GOING TO THE ERECTOR SPINAE MUSCLES
THE MUSCLES IN THE MIDDLE OF THE BACK
ANTERIOR BRANCHES OF SPINAL NERVES GOING TO INSIDE AND OUTSIDE OF BODY - EXCEPT THE ERECTOR SPINAE MUSCLES
LUMBAR SEGMENTS
SACRAL SEGMENTS
LUMBAR VERTEBRAE

Diagram to illustrate the fact that the point of exit of a spinal nerve is not opposite the location of its nerve cell in the spinal cord. Treatment, however, applied to the spinal muscles controlled by any vasomotor nerve, will affect the blood supply of the spinal segment from which the nerve starts.

Small intestine, 5th-11th dorsal.
Large intestine; first half, 6th dorsal-2d lumbar.
Large intestine; second half, 2d-5th sacral.
Legs, 3d-5th sacral.
Spleen, pancreas, 4th-10th dorsal.
Liver, 4th-12th dorsal.
External sphincter, 3d-4th sacral.
Kidneys, 6th dorsal-4th lumbar.
Coronary arteries, 1st-2d dorsal.
Blood vessels of cord, throughout entire cord.

Cervical cord, 2d-4th dorsal.
Skin and muscles of trunk, throughout the cord.

VISCERO-ACCELERATING OR DILATING

Pupil, 6th cervical-2d dorsal.
Bronchi and bronchioles (probably), 3d-7th dorsal.
Heart accelerators, 6th cervical-2d dorsal.
There are also viscero-accelerating neural units in same segments as the vasodilators to the following organs:
Esophagus, stomach, small intestine and ascending part of large intestine, nucleus of 10th and some in 11th cranial nerve.
Spleen, nucleus of 10th cranial nerve.
Cells which constrict Fallopian tubes, uterus, and dilate cervix uteri, etc., 2d, 3d, 4th sacral segments.
Cells which contract bladder and rectum and relax sphincter of both, 2d, 3d, 4th sacral.

A few anatomical landmarks may be helpful to some in determining the exact points at which to apply treatment. The spinal nerves to be affected, and the spinal segments from which they take their origin, are named from the vertebra above the point of exit of the nerve.

There are twelve dorsal, five lumbar, five sacral nerves, and one coccygeal nerve. The lowest (seventh) cervical vertebra (*vertebra prominens*) is a convenient starting point.

The seventh dorsal vertebra is about on a line connecting the inferior angles of the scapulæ.

The crest of the ilium (the highest point of the hip bones) is on a level with the spine of the fourth lumbar vertebra. Over the fifth lumbar there is no prominence, but a depression.

The sacral spinous processes are represented by three or four rudimentary tubercles; the first is usually prominent and perfectly distinct from the rest; the second and third are either separate or united into a tubercular ridge; the fourth, usually, and the fifth, always, remaining undeveloped. The third sacral is on a level with the posterior superior spine of the ilium.

At the crest of the ilium, the outer border of the quadratus lumborum extends an inch beyond the erector spinæ muscle, but at the twelfth rib, it lies an inch internally to that muscle.

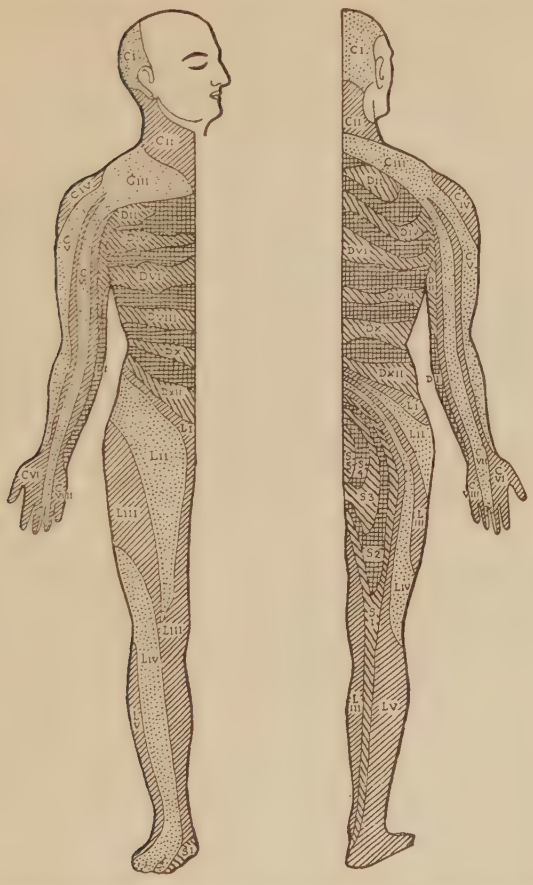
Musculomotor Segments

Key:

C=Cervical
D=Dorsal
L=Lumbar
S=Sacral
XIC=XICranial

Vent. Ad. =Ventral Adduction
Vent. Abd.=Ventral Abduction
Rot.=Rotation
Lat. =Lateral

	Flexion	*Extension*	*Lat. Adduction*	*Lat. Abduction*		
Head XIC-8C.	XIC-2C.	XIC-1-3, and 6-8C.	XIC; 1-8C.			
Arm 5C-1D.	Down: 5-8C.	Up: 5C-1D.	5C-1D.	5-6C.	Vent. Ad. 5C-1D.	Vent. Abd. 5-6C.
Forearm 4C-1D.	4C-1D.	4C-1D.	Supination 4-6C.	Pronation 6C-1D.		
Hand 4C-1D.	4C-1D.	4-8C.				
Thigh 2L-3S.	Raise Knee 2-4L.	4L-3S.	2-4L.	4L-1S.	Rot. Out 4L-3S.	Rot. In 4L-1S.
Leg 2L-2S.	Raise Heel 5L-2S.	2-3L.				
Foot 1-3S.	Raise Toes 1-2S.	Lower Toes 1-2S.	1S.	1-3S.		



Areas of anesthesia upon the body after lesions in the various segments of the spinal cord.

The segments of the cord are numbered: C I to VIII, D I to XII, L I to V, S 1 to 5, and these numbers are placed on the region of the skin supplied by the sensory nerves of the corresponding segment.—From "Nervous Diseases, Organic and Functional," Starr.

Diagram to show areas of skin controlled by each spinal segment.

CHAPTER V

OBSERVATIONS IN REGARD TO SPECIFIC CONDITIONS

Low Blood Pressure or Anemia of the Brain and Cord

This condition is due to hypotension of some or all of the abdominal vessels, aggravated perhaps by a weak or defective heart. Whatever nerve cells are the weakest, these will be the first to suffer from the resulting anemia. If motor cells are affected, any degree of muscular irritability or contraction may result; if sensory cells are affected, any degree of pain, from mere ticklishness to the most severe anemic headaches; and since the cells controlling so many vital functions, as respiration, heart action, and blood pressure, are located in the brain, it is obvious that cerebral anemia may produce any symptom, even death.

Any increase in hypotension at once aggravates also any local hyperemia, from conjunctivitis to sciatica, because the weakest vasoconstrictor nerves give out the quickest and to the greatest extent. Since there are billions of nerve cells in the cord and brain, any of which may be the first to starve out, it is easy to understand the great variety of symptoms which may result from hypotension. By overcoming the hypotension, any weak nerves can be gradually strengthened, thereby curing all kinds of subjective as well as objective symptoms. It has cured insanity, phobias, tremors, spasmodic muscular contractions, all kinds of functional diseases of all the viscera, and all kinds of local symptoms due to local vasomotor weakness. In other words, correcting hypotension will reestablish the normal nutrition of the cord and brain and therefore cure any symptom due to excessive irritability or weakness of nerve cells.

The anemia will be aggravated by fatigue, excitement, heat, cold, gravitation, indigestion, or the monthly period. If the nerve cells are extremely irritable, the slightest variation in the rate of blood flow may be sufficient to produce marked symptoms.

Patients with low blood pressure from hypotension can gradually bring the blood pressure to normal, and raise it when it falls, from any cause, by the application of alcohol to the spine, according to Directions, Chapter III. After one or more applications, the blood pressure stays at normal or above; usually for a time above normal. As explained above, patients in Class 1 (hypotension) pass into Class 4 and then to normal with a constant systolic blood pressure of 120 mm., diastolic 80, and the pulse at 72, 66, or 60. When applying the alcohol, use an atomizer and keep the rest of the body warm. Sometimes, as the blood pressure approaches normal, alcohol will begin to contract the stomach or intestines and so incarcerate the gas as greatly to disturb the circulation; at this stage Momentary Treatment with the finger will free the gas; and the alcohol may be applied a few minutes later. If the heart is weak, contracting the cutaneous vessels by the excessive use of the alcohol greatly increases the resistance to the heart. People with low tension can overcome much of the bad effect of heat and fatigue in hot weather by this application of alcohol. Many children with chronic troubles are simply suffering from hypotension and their future health may be established by an absurdly small amount of treatment with alcohol on the spine.

Any acute attack may be seriously aggravated by the use of alcohol. Diarrhea, neuritis, and other acute attacks, in those with chronic hypotension, are due to a temporary hyperemia of one or more segments and require light Prolonged Treatment for proper segments.

Raising the blood pressure to normal and maintaining it there, until the vasoconstrictor and cardiac centers become strong enough to maintain the normal circulatory conditions, will reduce the excessive irritability of any nerve centers, but exercise, baths, and manipulations, even if they temporarily

mechanically accelerate the circulation, unless carefully checked by blood pressure tests, may lower rather than raise the blood pressure.

If patients have had some previous rest and the nerve cells are ready to resume their normal function, as soon as the circulation is reestablished the response to the first treatment is often magical. The difference in the response between cases which had, and those which had not had rest, has given some measure of the relative importance of rest and of reestablishing the circulation as therapeutic proceedings. Because the patient was thoroughly rested, a single treatment has relieved hypotension and has cured conditions, varying from extreme ticklishness of a lifetime to chronic appendicitis; it has cured also chronic anemic headaches, mental depression, phobias, and facial tics. When there is abdominal hypotension, the cerebral vessels relax simultaneously with the abdominal vessels, but if the abdominal relaxation is extreme, it may drain the blood from the brain to any extent. Patients with a florid complexion and a tendency to abdominal hypotension, may become purplish in the face as the circulation slows down, and the corresponding slowing of the cerebral circulation acts as a most powerful irritant to all nerve cells, affecting the most sensitive first.

All the serious symptoms resulting from anemia of the brain may persist for years after some great emotional shock which causes the fall in blood pressure. A few treatments, sometimes a single one, may restore such a patient to health, because as soon as the normal circulatory conditions are restored the cells in the cord and brain at once resume their normal activity; whereas, in an apparently similar condition which is the result of fatigue, it may be necessary to maintain the circulation at normal by treatment for some time, for the exhausted cell bodies (including the vasomotor) to become sufficiently well nourished to maintain their normal activity. The time required for nerve cells to be restored to their normal activity after the circulatory conditions have been restored to normal, depends chiefly on the degree of fatigue and consequent irritability. Those cases of nervous weakness where the circulatory disturb-

ance was caused by an emotional shock are the class which have sometimes been suddenly cured by some other shock or emotion. Such shocks cause an improvement in the circulation which is sufficient to reestablish the normal activity of all the nervous mechanisms. Unless the rate of the circulation of a man's blood stays at normal his daily income of nutrition is below normal; this inevitably increases the irritability of all nerve cells unless one is leading so quiet a life as to keep the expenditure less than the limited income. This is just as true of a high blood pressure which opposes the heart action.

The immediate changes in objective, as well as subjective, symptoms produced frequently by single treatments, prove at once how many mental states and nervous and functional disorders are due entirely to a depressed circulation. As the vasomotor tone of the abdominal and cerebral vessels increases, the same causes of excitement will have less and less effect on "nervous" patients, but this is not the result of more will power but of the greater tone of the automatic nerves. If a fall in blood pressure of 30 mm. below normal is noticeably weakening to anyone, should it then be thought strange that the slowing of the circulation produced by a fall of only 10 mm. will gradually starve the nerve cells of the spinal cord and brain? A fall of 10 mm. in the blood pressure represents a very considerable slowing of the rate of blood flow, on which the life of the cells depends.

If one has great hypotension, the additional relaxation of the blood vessels, produced by lying down, will aggravate all symptoms; hence the danger of extreme rest cures for those with hypotension. On the other hand, on account of the greater force of the heart action during exercise, some patients can play tennis for two hours with less fatigue than from a half-hour walk which was too slow to increase the heart action sufficiently to overcome the effect of gravitation. Standing is most exhausting. Some people who could hold a tennis racket an hour, could not hold a book a few minutes, but this is not a question of psychology but of the physiology of the circulation. Similarly, hypotension will explain a great variety of other mental

and physical symptoms and apparent contradictions. Those with hypotension should exercise as actively as they are able and then at once lie down. Marked hypotension affords the best opportunity to demonstrate the constant and absolute relation between the irritability of nerve cells and the rate of flow of the blood. Incidentally it also demonstrates the possibilities and marvelous accuracy of spinal treatment. Because the cells are already somewhat starved out by the chronic hypotension and the cord is already anemic, a few moments of Prolonged Treatment for the segments controlling the arms and legs may so aggravate the existing anemia as to make it immediately difficult to use the arm or to walk. Pain in any part of the intestines may be produced and relieved in a few minutes. This condition is often called "chronic appendicitis," but when this pain can be relieved or excited by right or wrong treatment, it proves that it is due to the pressure of gas at the ileocæcal valve. The abscesses which may result from such a chronic condition in the appendix, or any other tissue, even if they require operation, should not be regarded as causes but results of the previous starvation of the controlling nerve cells. With hypotension any amount of gas may be manufactured in the stomach as a result of Prolonged Treatment over the proper segments. The weaker the nerve cells, the greater the effect produced. Since aggravating hypotension will aggravate all symptoms, even the throbbing of an abscess, and since curing the hypotension will cure so great a variety of symptoms and diseases, it follows that hypotension should not be regarded or treated as a symptom, but as the possible cause of any condition from melancholia to tuberculosis or arthritis. Certainly, if the hypotension is great and is not relieved, no tissue has a chance to recover.

The most remarkable fact in regard to the circulation, is the immediate and complete change which occurs in the circulation to the spinal cord as soon as the application of alcohol has produced a normal contraction of the abdominal blood vessels. Wherever the spinal cord has been the most anemic, it becomes at once the most hyperemic and requires usually heavy Pro-

longed Treatment for the same people who would have been injured by the lightest manipulation possible. Wherever the spinal cord had been most anemic, the visceromotor nerves would be the most starved out, and therefore the most irritable. Such areas will, therefore, require the most Prolonged Treatment in order to relax the contracted intestines. It has required from one day to a year's application of alcohol to overcome hypotension. The blood pressure was 75 mm. in the patient who required a year to bring it to 120 mm. This change from Class 1 to Class 4 was mentioned in the general Summary of Conditions of the Circulation. It is very easy to give patients who have passed from hypotension into Class 4 (hypertension of visceral muscles) so much treatment as to relax the arteries as well as the intestines and throw the patient back into Class 1. This is the most difficult point to learn in regard to spinal treatment, especially because the blood pressure varies little at this stage. If the patient is working hard, fatigue also will have a tendency to relax the arteries and bring on the previous hypotension. Too much Prolonged Treatment will bring back any symptoms which the alcohol has relieved, but if so, the alcohol must be resumed and the nervous system will be found to be in a much stronger condition than when the alcohol was first begun.

If a patient with general hypotension (Class 1) has passed into the condition requiring Prolonged Treatment for the upper third of the back, it will be best for some very sensitive patients not to use cold for the middle third of the spine. Momentary Treatment with the finger will be best for the middle third of the spine, unless the patient is having frequent treatment for the upper dorsal segments. This is because the contraction of the abdominal vessels produced by the alcohol will force more blood into the already hyperemic upper dorsal segments and aggravate cerebral and other symptoms (stiff neck) until there is some improvement in the vascular tone of this area.

Unless persistent and thorough Prolonged Treatment can be given at the time, the circulation may be poorer when one first passes into Class 4 from Class 1. All symptoms will be worse,

therefore, and for those with extreme insomnia, insanity, or a weak heart, the change will be a critical one requiring very careful treatment.

If the blood pressure is low from loss of tone of abdominal vessels, the heart action may be strong and yet the patient very weak; in this case Momentary Treatment at once contracts the abdominal vessels, raises blood pressure and relieves the anemia of the brain and cord and the patient's strength returns rapidly. If there is hypotension in any area, alcohol should be used on the spine, because even the lightest finger treatment lowers the blood pressure if the vasomotor nerves are weak. Applications of alcohol have cured patients who for months and years had been too weak to sit up, or too weak to endure any massage or other manipulation.

One of the greatest dangers of adding to the anemia of the cord by giving Prolonged Treatment, especially to a case of low blood pressure, is the immediate production of large quantities of gas, which become at once the cause of cardiac and other disturbances. Alcohol will at once reduce the production of gas. Low blood pressure may be increased by cold, which may aggravate the existing anemia or produce a hyperemia of the upper dorsal segments only. The former condition produces a passive and the latter an active hyperemia of the blood vessels of the stomach, and the rapidly produced gas oppresses the heart action. Prolonged Treatment for these segments diminishes the production of gas and raises the blood pressure. If there is hyperemia of these segments, alcohol would increase the formation of gas. Sometimes the blood pressure is above normal, even when there is a general arterial hypotension. This is the result of incarcerated gas. The blood pressure falls to normal or below immediately after Momentary Treatment, as the gas moves along to the lower bowel, where it is reabsorbed.

Blood pressure may be too much reduced also by Prolonged Treatment over upper dorsal segments which contain the accelerators of the heart. This must be carefully watched in all cases of weak heart action, as, for example, in smokers. In a critical case, such treatment might be fatal. Vasomotor changes

in vigorous people, whether produced by fatigue, indigestion, cold, excitement, or by mechanical means, are less in amount and of shorter duration than in the weak, because healthy people have the best arterial tone. In treating all cases of hypotension it is of vital importance to bear in mind the following facts: Just as fatigue may raise the blood pressure in those with high blood pressure, so also for those with apparently a normal blood pressure fatigue produces an irritability of the vasomotor and cardiac centers which may maintain the blood pressure at a point higher than if the patient were relaxed or rested. Therefore, even if the blood pressure is normal, it will drop below normal as soon as the patient begins to relax. If the blood pressure has been subnormal the fall in pressure may be serious because if the patient relaxes or "gives up" the pressure may fall to a point where the stomach or bowels will fill with gas, or other distressing or serious mental or physical symptoms develop. This is the condition of those people who are afraid, and often with good reason, to stop overworking. It is the explanation of much "Sunday sickness."

This is especially true if the patient has been kept going by means of tonics, tobacco, alcohol, or other stimulants, which are ruining so many; even coffee may contribute to this result. There may be for such extreme cases a sudden drop in blood pressure following even the slightest Momentary Treatment (sometimes 40 mm.). One can estimate very exactly the vascular instability of such patients by noting the amount of fall in blood pressure after the lightest Momentary Treatment (given with the finger). As the patient's vascular tone improves there will be less and less fall and finally there will be a slight rise in blood pressure after the same amount of treatment.

When a patient with low blood pressure is unusually tired, the usual amount of Momentary Treatment with the finger may lower the blood pressure still more. If the patient has extremely low blood pressure, even if manual Momentary Treatment does not accelerate the pulse by dilating all the abdominal vessels it might temporarily produce some local hyperemia, *e.g.*,

immediately increase the activity of the kidneys. One cannot use too much caution in treating low blood pressure in weak or fatigued patients. Alcohol, or some similar spinal application, is the only safe treatment for hypotension. This is because the vasomotor nerves to the skin and muscles are so sensitive and irritable that the lightest possible touch with the finger, instead of causing a constriction, produces a local dilatation with a consequent drop in blood pressure and aggravation of all symptoms. This condition may exist only in limited areas in some patients. In all such cases the application of just enough alcohol along the spine to produce a cool feeling, will produce vasoconstriction and gradually raise blood pressure even in those whose blood pressure would be lowered by the lightest pressure of the fingers.

The amount of disturbance caused by acute or chronic hypotension depends on the fatigue and consequent irritability of the nerve centers in the brain. A previously well man will endure the greatest vascular fluctuations. If the cells are exquisitely sensitive from fatigue, or from long continued anemia, they respond incredibly to the slightest vascular variations; hence variations in pulse and blood pressure which are usually considered normal are very serious to those with the most sensitive nerve cells. In cases of this extreme loss of vascular tone, a cold bath, by raising resistance to heart action, by contracting external blood vessels and forcing the blood into the abdominal vessels, will aggravate all symptoms. A hot bath, by dilating all blood vessels, will lower general blood pressure, thereby slowing the circulation, and therefore may aggravate all symptoms.

The maintenance of normal blood pressure depends on normal vasoconstriction in four somewhat distinct vascular areas; the splanchnic, the skin, the muscles, and the brain, as well as on a normal heart action. The vascular balance between the blood supply of the abdomen and of the spinal cord and brain is very delicate and a very slight relaxation or contraction of the abdominal blood vessels will produce an immediate variation in the blood supply of the brain and spinal cord. This affects at once the activity of all, or, at first, of only the most irritable

nerve cells in the brain and cord. In cases in Class 2, with abdominal hypotension and hypertension of the gastric muscles, considerable variation in the rate of the cerebral blood supply may be produced without affecting the general blood pressure. The pulse will be noticeably weaker when the abdominal vessels dilate or if the pylorus contracts.

For patients with low blood pressure a cathartic may be dangerous. Even if the blood pressure is 160 mm., if there is a marked loss of tone of the abdominal vessels, a cathartic may cause a faint. When there is weakness of the restraining neural units to the bladder, a hot bag over the lumbar region will cause frequent urination by diminishing the activity of already weak inhibiting nerves. A hot bag over the lumbar region, by diminishing the activity of vasoconstrictors may cause dilatation of abdominal vessels, dizziness, and palpitation of the heart.

The foregoing facts explain the intense suffering caused patients with low tension by all routine treatments, whether hydropathic, electrical, or manual, or by the usual advice given as to exercise, baths, diversion, and the like. These are the most hopeless invalids, whom all treatment, whether general or local, has either injured or failed to help. To attribute the results of hypotension to hysteria, or psychic disturbances, is inadequate and exposes an ignorance which is inexcusable.

Hyperemia of the Brain and Cord

The immediate cause of the symptoms of hyperemia is hypertension of the abdominal vessels, coincident with varying degrees of loss of tone in local areas of the cord and brain. The effects of hyperemia of the brain have been discussed in Chapter II. As before stated, it is the slowing of the rate of flow of the blood which disturbs the function of the nerve cells in all or in any part of the central nervous system. If the heart is strong enough for the extra work caused by the increased abdominal resistance, and the tone of the cerebral vessels is good, no bad affects will appear; as soon, however, as the rate of blood flow is retarded, immediate symptoms will appear, if the nerve cells are hypersensitive, because the process of gradual starvation

has begun. If the cells are originally strong and the depression of the circulation is slight, years may elapse before serious symptoms appear. Very slight chronic variations from an absolutely normal pulse and blood pressure are quite sufficient to account for otherwise unaccountable symptoms. With some patients, a variation of only two beats from the normal has meant a sudden contraction of the intestine, producing constipation which only the most powerful cathartic could overcome; and the moment that treatment was given, for only one segment, to relax the contracted intestinal ring, the pulse returned to normal. Many similar illustrations might be given to prove that no one can do exact therapeutic work if he regards as normal the wide variations of the pulse and blood pressure usually called normal.

If any degree of abdominal hypertension persists or increases, any degree of irritability of any nerve cells in the spinal cord or brain may develop; as the nerve cells starve out, any kind or degree of functional disturbance may develop; in time, actual tissue changes will result. The results of hypertension are largely the same as those following hypotension, because the rate of flow is retarded in each condition, but obviously gravitation would aggravate hypotension but not hypertension.

It is perhaps superfluous to enumerate the various results of hyperemia of the cord, since they represent the greatest variety of symptoms, depending on which of the billions of cells are the first to give out.

Finally, the retardation of the general circulation from hypertension increases the irritability of the vasomotor cells, which are responsible for the hypertension, and sooner or later this vicious circle throttles the circulation, causing the heart to give out, unless apoplexy or some kidney complication ends the life. "Hardening of the arteries" (arteriosclerosis) is, therefore, at least primarily, an effect of excessive vasomotor irritability.

When lowering a high blood pressure a large part of the treatment can be carried on by the patient. This greatly accelerates the recovery, reduces the number of treatments to

the minimum, and enables the patient to relieve himself of any of a great variety of acute attacks, produced by cold or fatigue. (See Directions.)

Arteriosclerosis

Simply because the blood pressure is high, unless there are extensive arterial degenerations, it is as misleading to tell a patient that he is suffering from a hardening of the arteries as to tell a man with a stiff neck that he is suffering from hardening of the neck. Any muscle becomes hard when it contracts, but excessive nervous irritability is the cause of the muscular contraction. "A man is as old as his arteries," but the tone of the arteries depends on the irritability of the controlling vasomotor nerves and if the arteries are contracted or relaxed too much, the strength is impaired or the life imperiled. The blood pressure is so frequently raised by the pressure of incarcerated gas that this must be eliminated before making the diagnosis of arteriosclerosis. Simple hypertension of arterial muscles can be relieved by treatment just as the contraction of skeletal muscles can be relaxed. Also arteriosclerosis is not necessarily general. This is the only explanation of the improvement produced in this condition even with a blood pressure of 250 mm. Incidentally, when treatment does lower the blood pressure in a case of arteriosclerosis it proves that the hardening of the arteries was not the "cause" of the high blood pressure. Hypertension of any part of the alimentary tube, even with a normal blood pressure, may produce most of the symptoms of arterial hypertension, and may be just as serious. The heart action is so oppressed that the high arterial tension is overlooked. Any organ may become congested and the cord is hyperemic. This condition requires, therefore, the same treatment as high blood pressure.

In many people, the most irritable nerve centers are those controlling the contraction of the pylorus (*q.v.*), and adjacent powerful vasomotor mechanisms. Any excitement, any food difficult to digest, any exposure to cold, any blow on the body, any irritation of any part of the nervous system (as dysmenor-

rhea) instantly may cause contraction of the pylorus and the adjacent vasomotor mechanisms. The rate of flow of the blood through the head is then retarded even though the heart is beating heavily and the pulse pressure is high.

Incarceration of gas in any other part of the alimentary tract will produce the same chain of symptoms. This depression of the circulation will cause or aggravate any other symptom, whether it is a psychic disorder or some other more obviously physical disturbance.

Congestive Headache

When there is hyperemia of the external tissues of the head, it may produce a "congestive headache." This may be due to a disturbance of the vasomotor mechanisms in the upper dorsal segments only, or also usually to abdominal hypertension, complicated more or less by the retention of gas in the stomach or bowels. A "neuralgic headache" may result from this same local or general disturbance of the circulation. Neuralgia may result also from low blood pressure; like all other conditions, anemia or hyperemia of any segment of the cord disturbs the activity of the weakest cells there. For acute congestive headache give Prolonged Treatment, especially for the second to the fourth dorsal segments, and also for whatever other dorsal, lumbar, or sacral segments are responsible for the arterial hypertension, or for contraction of the pylorus or intestines. The throbbing of a headache is the result of the extra effort of the heart to pump the blood against the extra resistance offered by the contracted arteries and incarcerated gas.

Never give Momentary Treatment for any segments in treating an acute congestive headache; but sometimes it is helpful to give some steady pressure across the suboccipital or supraorbital nerves. Applying heat to the feet often is helpful, but usually unnecessary.

Cold, which causes a contraction of the intestinal muscles and dilatation of gastric blood vessels, producing more or less flatulence, is the usual cause of a sudden, marked, and, perhaps, persistent rise in blood pressure. Indigestion and excitement

come next in order of frequency, especially if the nerves are irritable from fatigue. The patient may be quite unaware of the abdominal disturbance until it is detected by palpation of the abdomen. Headache may of course be caused by pelvic congestion or any sufficient irritation of any nerve in the body, but the use of a heart depressant can have no relation to the cause. The immediate belching of gas or its passage into the intestine after treatment, with a coincident and immediate return to normal of the pulse and blood pressure, is a demonstration of the relation of incarcerated gas to many circulatory disturbances.

If a patient has worked for years, with more or less constant headache, the headache may be worse when he is obliged to stop work and rest, because resting, especially reclining, produces a vascular relaxation and the vasomotor mechanisms for the head are too fatigued to maintain proper arterial tone. If the loss of the vascular tone affects especially the cerebral vessels, there will be motor, sensory, or mental disturbances according to the areas involved.

Very many acute headaches are the result of extreme contraction of occipital muscles which can usually be relaxed by a single treatment. If it were the muscles of the abdomen they would be carefully examined and operated upon, but because they are in the neck they are rarely even examined.

Most acute headaches are relieved at once—chronic headaches as the weak nerves gradually become stronger. As is the case in treating any chronic condition with hypertension, the spots which require Prolonged Treatment are usually more sensitive than others.

Vertigo

In all the patients the writer has treated who were troubled with vertigo, either acutely or chronically, the dizziness was the result of diminished rate of blood flow through the brain, the result of arterial or visceral hypertension or hypotension. Similarly, a dilated stomach from hypertension of the pylorus may cause vertigo by oppressing the heart. With hypotension, Pro-

longed Treatment for the abdominal segments would instantly aggravate the dizziness, and Momentary Treatment, or a little alcohol, would reduce it. Weak heart action, when due to abdominal resistance, is at once strengthened by Prolonged Treatment for the abdomen.

Excitement

Great excitement usually produces at first a violent contraction of the abdominal muscles and blood vessels, and also contraction of the spinal muscles innervated from the same segments, but with low blood pressure there is an immediate fall in pressure after the preliminary rise. If the abdominal vessels have little tone, excitement may instantly cause a fall in blood pressure, as when one faints. The constant relation between mental states and the rate of blood flow has been discussed, but nothing is more striking than the immediate changes which frequently follow a treatment for anemia or hyperemia of the brain. It is probable that the purpose of the rise in pressure produced by excitement is to supply a greater amount of blood to the brain to enable it better to meet the emergency.

Shock

Shock, as defined by some writers, is a condition in which the blood pressure is as low as 50 per cent of normal, resulting from extreme dilatation of the blood vessels. It may follow a severe wound or a surgical operation. Those who have chronic hypotension will have a passive, and those with hypertension of the arteries and visceral muscles will have an active, dilatation of some of the abdominal vessels, or the heart action may be extremely oppressed by contraction of part or much of the alimentary or arterial tubes.

If the vasomotor, or other nerve cells, are excessively irritable a very slight physical or mental shock may produce any degree of vasomotor disturbance with any degree of immediate or gradually developing nervous trouble. Any resulting mental symptoms should be regarded as necessary physical results of the circulatory disturbances produced by shock. Even previously healthy soldiers develop all kinds of nervous symptoms

from shell shock. Circulatory disturbances in the brain should be corrected before resorting to psychotherapy. "Delayed shock" and the ultimate results of "traumatic neurosis" are not difficult to understand, if one realizes that the gradual starvation of cells may go on for years before they give out absolutely.

Slight or delayed shock from mental or physical causes aggravates the existing disturbances in the circulation, lowering a low pressure or increasing a hypertension of the arteries or gastric or intestinal muscles. It has been shown that shock produced in animals is not the result of injury to the nerve cells, but the result simply of anemia, and as soon as the circulation is re-established the effects of shock disappear. Similarly in human beings, it is the persistence of the disturbance in the circulation, produced by shock, which injures the nervous system by starving the nerve cells.

In shock or faint, the rate of blood flow through the brain is so retarded that the respiratory, cardiac, vasomotor, and other nerve centers in the brain are unable to perform their functions normally. If the normal rate of blood flow can be restored to the brain, these centers at once resume their normal activities.

To produce the maximum vasoconstriction for a faint, resulting from hypotension, Momentary Treatment is required to produce constriction of the largest blood vessels in the body and increase the blood supply to the spinal cord. Fainting may result from a hypertension which is too great for the heart to overcome, therefore the cause must be known before giving spinal treatment, but the general use of heat or friction, except on the spine, would be helpful in either case. After any surgical operation, or any bruise or sprain, unless there is low blood pressure from great hypotension, give Prolonged Treatment over the segments which control the blood supply of the injured organs, so as to quiet down the vasodilators which were thrown into activity by the operation. Just as the need and benefit of mechanical help is recognized in the treatment of faint, just so, in a less degree, spinal treatment increases the rate of flow of the blood going to the subordinate vasomotor

nerve centers in the spinal cord, and these centers at once (as can be shown by a sphygmomanometer) increase their activity and so improve their own nutrition as well as that of all the other cells of the body. Such treatment accomplishes sometimes in a moment what otherwise might require days or even years of waiting.

Neurasthenia

The immediate physiological cause of persistent neurasthenia is usually the vascular disturbance, but the vascular disturbance may be the result of a great variety of causes. There may be a constantly low blood pressure (loss of arterial tone) due to weakness of the vasoconstrictor nerves, or high blood pressure from irritability of the vasoconstrictor nerve cells, which increases the resistance to the heart action; or the arterial tone may be normal but the pulse weak from incarcerated gas. In any case, the resulting slower circulation impairs the nutrition of all tissues, including the nerve centers of the spinal cord and brain. This may cause more or less "auto-intoxication" of the cells of the body from the slowing of the circulation and consequent accumulation of waste products in the blood and lymph; even gangrene may follow a disturbance in the circulation, but these so-called "toxins" are not therefore always absorbed from the tonsils, teeth, or digestive tract. This is proved by the immediate changes in the activity of nerve centers, when the rapidity of the circulation is brought to normal.

With a retarded circulation, even long nights of sleep may fail to give the usual recuperation. The greatest relaxation of blood vessels in any weak condition occurs in the splanchnic area. If the abdominal muscles are relaxed the condition is still more aggravated.

The term "neurasthenia" has usually a very vague and general use, but even in strong people, with some local trouble, there is a neurasthenic condition of the nerve centers controlling the blood supply or functional activity of the affected part. Consequently, the effects of heat, cold, fatigue, and flatulence are produced in a marked degree in the local area, even though the

rest of the patient's anatomy can withstand these causes of disturbance. The general strength of such patients and their disregard of the effect of cold and fatigue is often responsible for the persistence of these chronic troubles.

Neurasthenics may have high blood pressure, aggravated perhaps by chronic indigestion. People may be found with every degree of vascular tone, from the vigorous arterial tone and consequent rapid circulation of the man in perfect health to the relaxed vascular condition of the patient who faints whenever fatigue or excitement causes the abdominal vessels to dilate and so deprive the brain of its necessary blood supply. Many so-called anemic patients have sufficient blood of normal quality but it does not circulate rapidly enough to nourish the tissues, because of the relaxation or hypertension of the blood vessels. Even if the number of red or white corpuscles is deficient, spinal treatment improves the circulation to the spleen, bone marrow, and lymphatic glands, where the constituents of the blood are manufactured, and rapidly thereby increases the hemoglobin content of the blood when the use of iron has proved useless. Many people supposed to be suffering from "too much blood," are really suffering from arterial hypertension, complicated often by lack of tone of the blood vessels of the head.

If the patient is neurasthenic and has a low blood pressure, it will obviously take longer to cure a local trouble than when the general arterial tone is better. It is necessary to bring the general arterial tone up to normal before local vascular relaxations can be cured.

The rest cure as a form of treatment for neurasthenia is capable of greatly injuring the patient, especially one with low tension, because of the additional relaxation of the blood vessels produced by prolonged rest.

In addition, disuse is always weakening. Even a joint may become immovable from disuse. The lack of healthful occupation for the mind leads to hypersensitiveness to all sensations.

If a man's pulse or blood pressure is further from normal a reasonable period after exercising, he is too fatigued and the circulation will be still slower when he ceases the exercise.

Nothing can be beneficial which diminishes the activity of the circulatory apparatus, for this is essential to the strengthening of the central nervous system. If a man's circulatory apparatus is exhausted, either from mental or muscular work, he should exercise cautiously.

Those who had extreme hypotension before beginning treatment, will pass through a period of hypertension of the intestinal or gastric muscles before the blood pressure remains normal, because the irritable visceromotor nerves contract the intestines and incarcerate the gas (see Class 4). "Atonic" constipation, gastric and cardiac dilatation may follow starvation of the controlling visceromotor nerves, with low blood pressure from hypotension. The stomach is usually distended with gas, and may become the cause of vertigo, palpitation, and ultimately of the failure of the heart. Hypertension of the pylorus (pylorospasm) may occur with those in Classes 2, 3, or 4 and cause dilatation of the stomach, but this requires exactly opposite treatment from the dilatation of the stomach with hypotension (Class 1).

Insomnia

Insomnia is one of the commonest manifestations of cerebral irritability. It is usually the immediate result of a disturbed rate of flow of the blood through the brain, but the rate of blood flow may be disturbed by a variety of causes. If the underlying vascular disturbance can be corrected by a single treatment, the insomnia may disappear at once; if the insomnia is due to a prolonged starvation of the brain or to chronic indigestion, which depresses the circulation, the insomnia will disappear as soon as the digestion has been sufficiently improved so as not to disturb the circulation. The retention of gas is the usual cause of the disturbed circulation.

During any course of treatment it will be observed that the insomnia is uniformly aggravated by any increase of the indigestion and the inevitable disturbance of the circulation.

It is commonly asserted that eating predisposes to sleep, because "it draws the blood away from the head to the digestive

tract." However, since eating often raises the blood pressure and usually makes the pulse stronger, and since treatments which strengthen the pulse also immediately make patients drowsy, this explanation is unsatisfactory; whereas, it agrees with the general physiological relation between nervous irritability and the rate of blood flow, if we recognize the obvious fact that the brain is chronically irritable and sleepless whenever anything interferes with its normal nutrition. The fact that certain forms of organic heart disease cause insomnia, is another illustration of this law.

Many people with insomnia will follow a careful and sensible regime all day and then use the brain the last part of the evening, instead of taking a little exercise. The mental work produces the maximum disturbance in the cerebral and general circulation and may make getting asleep most difficult. Many times a little reading which diverts the mind and alters the cerebral circulation encourages sleep, but mild exercise, not hard enough so to accelerate the heart action as to increase the blood supply to the brain too much, is usually best.

Most people with insomnia have a marked disturbance in the circulation; all cases have sufficient to irritate the brain. Usually the blood pressure is above or below normal, and the insomnia is aggravated by whatever adds to the existing disturbance; but as soon as the circulation is brought to normal, sleep inevitably follows; and this is true even with people who are suffering from some recent bereavement—supposed to be the cause of the insomnia—the shock of which has disturbed the circulation and consequently the brain.

The results of reestablishing the normal circulation are most striking in children who are sleepless or "hysterical." They are too young to employ mental expedients, but as soon as the circulation is normal they sleep normally, usually after a few days. Incidentally, some of them have been cured of certain fears which their parents had not mentioned until after they had disappeared, thereby showing they were not cured by mental suggestion, but as soon as the brains had a normal blood supply they became normal in function.

Within certain limits a low blood pressure with a good pulse makes people feel drowsy, and they also require more sleep than those with a more rapid circulation; but when the cerebral anemia reaches a certain degree, it so irritates the brain as to cause insomnia. Insomnia with low blood pressure is often greatly relieved by warm applications to the feet. If the heat dilates the blood vessels of the body and brain too much, it prevents sleep. Short of this point, warmth encourages sleep. Using heat for long periods, *e.g.*, sleeping with a warm water bottle, relaxes the blood vessels, increases the low blood pressure and aggravates all symptoms.

Mental Disorders

Mental disturbances due to organic changes in the brain will not be discussed. The psychoses, melancholia, phobias, and obsessions of neurasthenia, treated by the writer, were due to excessive irritability of part or all of the brain. This irritability was caused, exaggerated, or relieved by the same variations in the rate of the blood supply which cause, increase, or relieve irritability of nerve cells in the spinal cord.

In watching patients, it becomes evident that, if the brain cells are very irritable, the slightest variation in the rate of blood flow will at once increase the patient's suffering. In some cases the blood pressure may be normal, but if the pulse varies three beats from the absolute normal, it may be quite sufficient to cause great disturbance, and when the pulse has been perfectly regular, a rise in blood pressure of only 5 mm. has been sufficient to cause considerable mental disturbance. The fact that psychic stimulation may disturb the blood pressure has been discussed, but if day after day, in each patient, the mental disturbance is always proportionate to the circulatory disturbance and is diminished or disappears as soon as the rate of blood flow has been brought to normal, it becomes evident that the psychic disturbance is usually an *effect* and not the *cause*.

When the brain cells are excessively irritable, either from a temporary vascular disturbance or as a result of preceding long continued starvation of the cells, any idea, either from

within or from any external source, may be extremely irritating or exciting. A great variety of mental diseases are essentially the same, because they are due to the most excessive irritability or starvation of some of the billions of nerve cells in the brain. It is obvious, in view of the fatigue and extreme irritability of certain nerve cells in the cortex of insane patients, that the routine proceedings of cold douches down the spine, long walks, and powerful depressive drugs, may be the most successful method of preventing the recovery of the patient.

A recent writer on the disorders of speech occurring in mental diseases, observed that a drunken man may pass through all forms of disorders of speech of mental diseases. If the circulatory disturbances in the brain caused by alcohol can produce so many symptoms of the insane, is it unreasonable to suppose that chronic disturbance in part or all of the cerebral circulation may be responsible for all the symptoms of many mental disorders, if we except those due to organic lesions? This is the only possible explanation of what has been accomplished by restoring a normal flow of blood through the brain. If, as stated in works on mental disorders, certain classes of patients have low blood pressure and cyanosis of the skin, what chance can there be for such patients to recover if nothing is done to overcome the anemia of the brain?

Even when mental disorders are due to an inherited tendency, fatigue and starvation may be the immediate cause of attacks. The starvation may be due to poor, insufficient, or improperly digested food, or the starvation is the result of an impaired rate of nutrition of the nervous system from a general or local depressed rate of flow of the blood. The disturbance in the circulation may be the result of any form of mental or physical shock; it may result from fatigue, which sooner or later affects the vasomotor nerves, from any severe illness or surgical operation, from excessive heat or cold, or from any infection or drug which disturbs any or all of the vasomotor nerves.

The patient may have a high, low, or normal blood pressure; everything depends on the rate of the blood flow. If this can be greatly improved by the first treatment, there may be an imme-

diate improvement in the symptoms. This improvement can be maintained and increased just in proportion as the unstable circulation can be maintained at normal. The amount of disturbance produced in all conditions by cold, fatigue, indigestion, or mental causes, depends as much on the degree of irritability of the particular nerves involved as on the intensity of the stimulus. In insanity, there is an infinite irritability of the nerve cells and the most insignificant draught of air may instantly produce in those with high tension the most powerful contraction of the gastric, intestinal, or arterial muscles. This throttles the circulation to the brain and aggravates the symptoms of insanity or any other nervous trouble.

Anemia or chemical irritation of the cerebral centers may produce subjective symptoms (*e.g.*, itching) very distressing to the patient, but this is as much beyond the patient's control as eczema and should be treated from the standpoint of physiology and not psychology.

If an insane patient has a disturbed circulation, giving quieting drugs to depress the irritable nerve centers has no relation to the cause. Depressant drugs will increase the irritability of nerve centers.

Only nutrition cures irritability, and in nervous cases, and especially in the insane, we are dealing with infinitely irritable nerve centers in some part of the cord or brain or both.

As is stated in the section on cerebral circulation, the immediate changes produced in mental states by relieving abdominal and gastric disturbances, prove absolutely that abnormal mental states vary uniformly with the rate of the cerebral circulation.

Since fatigue increases the irritability of all nerve cells, and especially of the weakest, therefore exercise should be limited, and all other factors previously mentioned, which in any way increase nervous irritability, should be carefully considered.

Neuroses

Neurasthenia of limited areas of nerve cells constitutes a "neurosis." In all neuroses and neurotic conditions it should be

constantly borne in mind that, whatever other causes contribute to the result, there is a general or local vasomotor disturbance. The persistence of a neurosis is due also to the fact that an amount of fatigue which can be endured by most of the nervous system may be far too great for the neurotic area and if a cell is worked beyond its physiological income of nutrition, it becomes irritable. Even if the work is within normal limits and the blood supply is disturbed from anemia or hyperemia of special areas of brain or cord, the cell becomes excessively irritable.

It should be as proper to term it a neurosis whether the nerve cells involved are in the brain or the spinal cord; whether they are motor or sensory; whether vasomotor, visceromotor, or musculomotor.

If sensory nerves are affected, it may produce, for example, extreme ticklishness or hyperesthesia, so that slight stimuli may produce the most violent reflexes (musculomotor or vasomotor). If the vasomotor nerves to the mucous membrane of the nose or bronchial tubes are affected, a very slight stimulus may cause an attack of hay fever or asthma. If the visceromotor nerves to the pylorus are affected, dilatation of the stomach may follow on account of the abnormal irritability and consequent contraction of this important muscle. If the centers controlling contraction of ocular muscles are affected, strabismus may follow, or if the centers for the iris, there may be contraction or dilatation of the pupil. Spinal curvature from contraction of the muscles on one side of the spine is a result of increased irritability of the controlling nerve segments in one half of the spinal segments. All of these conditions demand treatment which is not anatomical but physiological.

A neurosis may be cured by anything which sufficiently improves the nutrition of the affected centers. Sometimes a mere emotional shock may cure a neurosis, but the shock must have produced a vasomotor change and restored the normal rate of nutrition of those cells. No nerve cells can functionate normally without a normal supply of blood. If the cell is extremely exhausted, any exercise may only add to the fatigue and irrita-

bility. If the cell is not too fatigued, exercise will strengthen it by bringing more blood to that part of the brain or spinal cord.

Exercising the right hand only may strengthen the grip of the left hand, because it brings more blood to, and produces a better nutrition of, those areas of the spinal cord and brain in which are located the nerve centers for both hands.

Anyone, from becoming fatigued or debilitated from any cause, or from shock or anything else which leaves a disturbance in the circulation, may develop a tendency to a spasmodic contraction of some facial or other skeletal muscle. It may be the pylorus or almost any other voluntary or involuntary muscle. Fatigue, cold, excitement, or indigestion may begin or increase the contraction. Sometimes merely thinking of the muscle will cause it to contract. Such conditions are promptly termed "mental," but unless the cells in the brain are excessively irritable, thinking about the muscle cannot cause it to contract. A patient, in recovering, will pass through all stages of irritability. At first, the merest thought may start the muscular contraction or some vasomotor symptoms, but as the nervous system becomes less irritable, the thought or fear will not cause the contraction or other symptom. Those whose nerves are least irritable or those with the most will power, may best control the condition; but on the other hand, the mere exertion of will power may aggravate the symptom by disturbing the circulation. Anyone whose condition requires constant mental effort to prevent the appearance of some symptom (either objective, as some twitching, or subjective, as some "phobia") is in a very precarious physical condition. Such a one should be strengthened physically and not simply urged to "cheer up" and "forget it" because the symptom is a danger signal and if disregarded it will sooner or later get beyond the control of the strongest will.

The brain can inhibit even respiration for a limited period, but as soon as the accumulating CO_2 sufficiently irritates the respiratory center, respiration recommences in spite of any mental effort. Irritability of any musculomotor, visceromotor,

or vasomotor center may also reach a point beyond mental control. It is not scientific to dispose of a patient's trouble merely by calling it a neurosis. When a neurosis is due to irritability of nerve cells, to treat it entirely from the psychological standpoint is misdirecting the attention. To treat a neurosis from the surgical viewpoint is a mechanical blunder. Dilatation of the stomach, from contraction of the pylorus, may be as purely and simply a neurosis as writer's cramp, since it is the result of irritability of certain controlling nerve centers. Stretching this or other similarly contracted muscles has no relation to the cause. Neither has cutting the nerve in spasmodic torticollis.

To treat this condition as a mental trouble is only adding insult to the patient's injury. To instruct the patient constantly to resist the pull of a contracted muscle can only add to the nervous fatigue and irritability and may induce a similar condition in the opposing muscles and cause complete mental fatigue by the effort to control the uncontrollable. Irritability means fatigue, and the patient is only as strong as the weakest segments. The trouble may be cured by treating the controlling segments and resting the cervical muscles as much as possible without weakening the whole body. Short walks, and supporting the head on pillows all of the rest of the time, when sitting, and even when riding in a carriage, will produce the quickest results. Whatever aggravates the anemia or hyperemia of the brain increases the irritability of all nerve centers. Even mental effort to control excessively irritable reflexes, may, for this reason, only aggravate the trouble. It may require as much mental effort for some people to raise the hands to arrange the hair as for a well man to run. To try to use some weakened or unpracticed muscles may cause a disturbance of the circulation which will remain all day.

Twitching of the facial muscles has been cured in a single treatment because the patient had been previously through a prolonged rest. The facial tic had not been cured, because the massage, electricity, and other methods of affecting the circulation had not accurately restored the delicate balance of the circulation in each spinal segment. As soon, however, as the

circulation was restored to normal, the rested cells were instantly ready to resume their normal work. This explains the nature of the cure of many people through some excitement. Although they were really ill when they first went to bed, the cells gradually recovered their strength, but until some mental excitement or some sudden exertion of will power started the normal circulation they had no strength.

The rate of recovery of any motor tic, or of the irritability of any nerve cells depends on the general fatigue of the nervous system, the consequent loss of general or local vasomotor tone, the age of the patient, one's opportunity to control the fatigue, cold, and diet factors, and, in extreme cases, on the intelligent cooperation of the patient. Nervous irritability can be gradually reduced with physical certainty, if one can maintain a normal rate of nutrition of the irritable cells. Controlling the circulation is only one factor, but usually the largest factor in the process.

Asthma

Asthma is due to excessive irritability of the vasomotor and visceromotor nerve centers in the fourth to seventh dorsal segments. Incarcerated flatulence, which will disturb the circulation and so aggravate any symptoms, is especially disturbing with asthma, since it presses against the nerve endings on the under surface of the diaphragm, thereby throwing into violent reflex activity all the overirritable nerves controlling the bronchial tubes. Lying down may do the same, because the abdominal contents press against the diaphragm. Chilling the spine may start an attack, either by causing flatulence or by disturbing the blood supply of the irritable nerve centers. Anything which disturbs the normal rate of blood flow to the controlling nerve cells will cause an attack, because it immediately increases the irritability of these centers. Flatulence in the stomach or intestine, either from cold or food, has been the immediate cause of most attacks of asthma treated by the writer, and the liberation of the gas should be the first step in treatment. Then Prolonged or Momentary Treatment must

be given according to the condition of the circulation. If the patient has a general cold, all the segments must be treated. Unless the nerves are unusually irritable, acute attack can be stopped by a treatment and in chronic cases the irritability of the nerves involved can be gradually cured. Organic heart trouble might prevent the cure of asthma as well as any other nervous trouble.

Hay Fever

This will be cured by reducing the irritability of the nerves supplying the mucous membranes of the nose. Until the blood vessels of the nasal mucous membrane recover normal tone one must be very careful of exposure to cold. Particularly the upper part of the back must be kept as warm as the rest of the spine to prevent frequent attacks. Just as cold air on a sensitive back will cause a contraction of the spinal muscles, or a little alcohol over the lower dorsal and lumbar spine will cause a contraction of abdominal blood vessels, so also cold, or a slight chill, will aggravate hay fever or cause an attack of asthma.

Enuresis is cured by reducing the irritability of the nerve cells in the lumbar and sacral segments. It has usually been due to hypotension and therefore has required alcohol applications until the patient passed into Class 4 which then required some Prolonged Treatment. Several cases were cured by a single application of alcohol.

Extreme Ticklishness of the back is simply excessive irritability of certain sensory nerves, and therefore this irritability is reduced by treatment, as readily as any other form of motor or sensory irritability. Several cases were cured by one treatment. Intense itching has been similarly relieved, the response to treatment depending on the vasomotor tone and the degree of starvation of the cells.

Dilatation of the Pupil varies with changes in the blood supply of the brain, consequently treatment has made very interesting and instructive changes even after years of variation from the normal.

Gynecological Disorders

In view of the certainty with which weak nerve cells in the spinal cord can be strengthened by restoring the normal vascular equilibrium, it is obvious that purely functional disturbances, such as amenorrhea, dysmenorrhea, menorrhagia, and metrorrhagia can be cured. Since single treatments have cured attacks of leucorrhea, from cold, which had persisted for one or two weeks, this shows how powerfully the functional activity of any tissue can be controlled. Even with organic tissue changes, the rapidity of the growth or of the reabsorption of certain neoplasms obviously depends on the vasomotor control of the tissue; consequently the restoration as far as possible of the normal nervous control of an organ or tissue is of vital importance in any condition. Muscular contractions and relaxations, anemia, hyperemia, and lack of development of uterine muscles, the agony from cramps, the stoppages from contractions, the malpositions from loss of muscular tone, the catarrhs and hemorrhages have been cured by restoring the strength of the controlling nervous mechanisms.

Obviously, the frequent presence of infections, either as a cause of irritation or as a result of lowered tissue resistance, limits the possibilities of spinal treatment and requires local treatment, but the mere removal of the infection alone does not necessarily restore the normal vasomotor tone of a tissue. The indirection, if not the futility, of many local treatments, not to mention the sufferings of the patient, are simply appalling. Even so apparently a purely anatomical condition as a displacement of the uterus, following fatigue and cold, with all the accompanying symptoms, has often been entirely removed by treatment of sacral spinal nerves only; indeed, many of the symptoms accompanying the displacement, and naturally attributed to it, are the result of contraction of sections of the intestinal muscles and blood vessels in the pelvic region, because the visceromotor and vasomotor nerve cells in the sacral segments were necessarily simultaneously disturbed.

The persistent use of hot douches to heal irritated surfaces of the uterus, for the removal of infections, or for the reabsorp-

tion of hypertrophied tissues is a very powerful means of favorably affecting the local circulation. This is an old-fashioned method of affecting the local blood supply, but it is confirmed by the modern "Bier Hyperemic Treatment"; certainly it is only the blood which can ever heal any tissue.

When treating dysmenorrhea and similar conditions, it is usually best to do nothing for a few days at the catamenia, except when necessary to relieve acute suffering. Usually the persistent use of the comfortably hot water bottle over the spinal sacral nerves will relieve cramp or congestion. Keeping the feet warm is also a great help in accelerating the general circulation and preventing local congestion. In extreme cases, rest in bed may be necessary or at least very beneficial. When dysmenorrhea is due, as is frequently the case, simply to excessive irritability of the visceromotor nerve cells in the spinal cord, all local treatment is unnecessary and inexcusable, because the contracted muscles will relax as soon as the spinal cord receives a normal blood supply. Often apparent ovarian pain is entirely due to the incarceration of gas in those parts of the bowels innervated from the same spinal segment or half segment as the ovary.

At the menses, those with a tendency to low blood pressure may have a drop in blood pressure of perhaps 10 to 20 mm.; those with the opposite circulatory tendency may have a rise in blood pressure, the height depending on the amount of pain, the strength of the heart, and the degree of irritability of all the nerve cells directly or indirectly involved. To relieve a resulting anemic or hyperemic headache or other symptoms, it is usually necessary to treat the splanchnic vasomotor mechanisms, because they control the largest vascular area, as well as the sacral segments which immediately control the cramps.

Prolonged uterine hemorrhage has been controlled in a most marvelous manner. The first treatment may stop a discharge which had continued for months. If the blood pressure is high, Prolonged Treatment will be required for both the lumbar segments containing the vasoconstrictors and for the sacral segments containing the vasodilators. If there is a general hypo-

tension, even though the blood pressure is normal because of rapid heart action, Momentary Treatment (alcohol) will be required for both the lumbar and sacral segments. Very often alcohol will be required for the lumbar and Prolonged Treatment for the sacral. Unless the anemia or hyperemia of each lumbar and sacral segment is exactly relieved, no accurate results will be obtained. Spinal treatment has been found to be of great value also in controlling the nausea of pregnancy.

Gastric Disorders

Flatulence

The relation between flatulence and blood pressure was discussed in Chapter II, Part 8. The secretion of gas seems to be controlled by the second to sixth dorsal segments, more by the left than the right side. The slightest degree of anemia or hyperemia of any part of this area may cause the secretion of any amount of gas. An area no larger than a finger tip may be the only spot to be treated, with an immediate reduction of the pain or distension of the stomach.

Food, fluids, and cathartics pass through tightly contracted rings of the stomach or intestinal muscles, where gas obviously has been retarded for long periods, because they start up a peristaltic movement which relaxes the contracted ring temporarily; but the pressure of gas seems to excite a contraction of intestinal muscles with normal tone but produces a dilatation of the stomach or of any intestinal loop, if incarcerated by a contracted pylorus or ring of intestinal muscle. Flatulence always distends the stomach, when there is general hypotension (Class 1).

In addition to the physiological disturbances produced by incarcerated gas, it may even so distend any part of the bowel as to form "phantom" tumors of large size, or by distending the stomach even cause the ribs to bulge on the left side.

By spinal pressure, especially on those having a tendency to the formation of gas, it can be proved, not only that gas is secreted in the stomach, but that this secretion depends on the degree of dilatation (active or passive) of the blood vessels of

some part of the stomach. This dilatation may be excited by too much or indigestible or acid food, and the food may flavor the gas, but the gas is not swallowed air as is commonly supposed, and is not, to any extent, the result of decomposition of the food. Confirmation of this statement may be found in the monograph of Crookshank on "Flatulence."

It is the pressure of gas which is the immediate cause of most variations in blood pressure and pulse. It may therefore aggravate any symptom whatever.

The amount of disturbance produced by incarcerated gas is always in proportion to the irritability of the nerves controlling the muscles of the stomach and bowel. An amount of gas which would cause no trouble when one is well, will cause any degree of disturbance as soon as the nerve centers controlling the stomach or bowel become irritable, either from fatigue or from the disturbance of blood supply to the spinal cord from any cause. The vasomotor disturbances produced by the gas seem to be in proportion to the severity of the contraction of these muscles.

Whatever depresses the rate of the circulation at once increases the irritability of these nerves to the digestive tract and the incarcerated gas at once aggravates the general or any local vasomotor disturbance; the depression of the circulation, therefore, also increases the rapidity of the manufacture of gas. "Acute indigestion" is the most familiar illustration of the vicious circle which is produced in this way; fatigue being often the cause of the underlying irritability of the nerves, and cold or very indigestible food being the immediate cause of the attack. Most invalids have a chronic vicious circle of this kind, which will aggravate any other chronic trouble, the severity of attacks depending on the vasomotor disturbance produced.

The continuous flow of gas from the stomach to the lower bowel is most easily demonstrated on those with low blood pressure and great irritability of the visceromotor nerves. With these conditions, very brief Prolonged Treatment over any half segment from the seventh dorsal to the fourth sacral will cause

a dilatation of some intestinal or gastric muscles with a rapid accumulation of gas at that point. The opposite treatment will produce an immediate reduction of the swelling by contracting the intestine and moving the gas along. When the rapidity of secretion of gas is excessive, as from cold, with the other conditions mentioned, great pain or distension may be produced at any point. A single treatment of the upper dorsal segments controlling the secretion of the gas has in a few minutes reduced abdominal pain and distension, diagnosed as appendicitis or floating kidney; and sometimes without treating any segments controlling the abdomen.

The contraction of some part of an artery, with the consequent disturbance of the circulation, is quite analogous to the contraction of any ring of the alimentary tract. In the one case the movement of the blood, in the other case the passage of the gas, is retarded or stopped.

It is not difficult to distinguish between those cases where the eructation of gas is due to relaxing the cardia of the stomach by treatment, and the cases where the rate of secretion is enormously increased. Where the supply is small, belching usually brings the pulse to normal at once. The use of a hot bag on the spine with low blood pressure, may so increase the secretion of gas as to cause one to belch almost continuously for hours, and a little alcohol on the spine may be sufficient to reduce its excessive manufacture instantly and soon leave the stomach soft and relaxed and relatively empty. If the vasomotor nerves to the stomach are very sensitive, gas may be manufactured as a result of purely psychic stimulation, just as saliva is secreted by the sight of food; but the amount of secretion is in definite relation to the irritability of the nerve cells in the brain and of the gastric vasomotor nerves involved.

The splanchnic vasomotor mechanism is by far the most powerful in the body. Hence the far-reaching effects of incarcerated flatulence which always disturbs the circulation. Since the action of the heart and the circulation of the blood to every part of the body are largely controlled by the vasomotor nerves of the abdominal vessels, and since indigestion (flatulence)

always more or less disturbs abdominal circulation, therefore any indigestion may aggravate any chronic trouble by disturbing the general circulation. Any disturbance of circulation always affects the weakest part of the body most.

Although flatulence has no necessary relation to the food, even though the food may flavor the gas, any food which irritates the stomach by its acidity or indigestibility may increase the amount of gas. Some people have indigestion from eating meat; they naturally derive great benefit, and perhaps a cure, by becoming vegetarians. Many of them forthwith try to manipulate the facts of physiology and Bible verses to prove that man belongs to the Herbivora, but, fortunately perhaps for them, without four stomachs. Other people, however, digest meat well and need the most nourishing food.

A low proteid diet may relieve the digestive apparatus of some work, but all indigestion is not the result of the nitrogen which has become so dangerous recently. Eating beefsteak may relieve the pain and other symptoms caused by hyperacidity of the stomach; because beef may diminish the acidity which causes the contraction of the pylorus with a long chain of possible results. An unripe banana would be worse for "rheumatism" than beef, because it is the disturbance of circulation rather than the absorbed poisons which usually makes trouble. People have been constipated for months without absorbing poisons. The mucous membrane was not made for the purpose of absorbing toxins, but a congested membrane may. "Autointoxication," as usually defined, as a cause of symptoms, is a supposition incompatible with the results immediately obtained by spinal treatment.

The most persistent constipation of weeks or even months may exist with fair health. All kinds of evils have been attributed to poisoning by the reabsorption of noxious matters from the retained fæces—copræmia—but it is not likely that this takes place to any extent.—Osler.

In giving spinal treatment it becomes most evident that attacks of flatulence, as well as more severe indigestion, in people who are at all careful in diet, are very often the result

of cold. This is usually proved by the coincident soreness and stiffness of neck and spinal muscles which could come only from cold. People usually attribute indigestion entirely to some special food, or to constipation (or are worried about "auto-intoxication") but the stronger the patient the more likely it is that the disturbance is from cold, for such people rarely protect their weak points because the rest of the body can resist the effect of exposure to cold.

If the visceromotor nerves are very irritable, eating *anything* may depress the heart action, sometimes as much as twenty beats per minute for a while after each meal. Obviously, many people are benefited by a restricted nonfermenting diet. Those who have been benefited by any "starvation treatment" belong to this class. A person can gain no strength from food if the heart is unable to propel the blood stream containing the nutrition at the proper rate. However, it is just as foolish to stop eating because one has indigestion, as to stop breathing because one has lung trouble. Those who are nervously exhausted would be most injured by a starvation diet. All irritable nerves need the maximum nourishment. If they receive more nourishment from a restricted diet, with improved circulation, than from a more general diet which slows the circulation, the former is the better alternative, unless the digestive disturbance is being controlled by treatment. In any case the food should be of the most easily digested kind. Routine forced feeding is utterly irrational and may impair a patient's nutrition by depressing the circulation.

Every few days the writer has been called upon to relieve some more or less severe attack of indigestion. This has been accomplished usually by a single treatment which gave complete relief, but it has required usually one and sometimes several hours to equalize entirely the circulation of each spinal segment. It has sometimes reduced the blood pressure 70 mm., the pulse thirty or forty beats, and the temperature as much as five degrees, with complete relief of all other symptoms, as neuralgia and headache or suppression of urine. In short, every nervous mechanism which was disturbed was brought to normal.

Sometimes it is better to relax the cardia and allow some gas to escape through the mouth (belching), instead of into the bowels where the sudden entrance of large amounts of gas will cause severe cramps. Except for occasional cases of extreme hypotension, to reduce the production of gas give Prolonged Treatment chiefly on the left side to the second to sixth dorsal segments, wherever the soreness or contraction of spinal muscles is greatest. No one would ever imagine the serious and remote symptoms, resulting from gas incarcerated in the stomach, which are immediately relieved by this procedure. Incarcerated gas produces the greatest possible variations in blood pressure and pulse, and any slowing of the circulation will aggravate any trouble. If the nerves controlling the pylorus are irritable, any source of irritation or fatigue of the nervous system (excitement, cold, the catamenia) may cause a contraction of the pylorus followed by an aggravation of existing symptoms. Prolonged Treatment over the fifth to ninth dorsal segments, chiefly on the right side, causes the gas to leave the stomach, often with considerable noise; the distended stomach contracts, the depressed or accelerated pulse returns to normal, and the headache or other objective and subjective symptoms disappear. In critical cases, it may be unwise to turn the patient on the left side on account of the greater pressure of the distended stomach against the heart. If the spine is very sensitive, the mere warmth of the hand over a few half segments, with no real pressure, has been sufficient to relieve the most intense pain and to lower the blood pressure sometimes as much as 70 mm. (See Warnings 2 and 3.) Contractions of the alimentary tube, even when the blood pressure is normal, may cause cardiac lesions just as high blood pressure may overtax the heart. The heart may be overworking for years and be regarded simply as a "nervous heart," until the organic change occurs. In giving treatment to relax a tightly contracted stomach it is most important to relax the pylorus, otherwise the stomach may dilate and press on the heart. Usually the pylorus is the most contracted muscle of the stomach.

Insomnia is usually the result of the vasomotor disturbances

coincident with or caused by incarcerated gas. Many people have suffered seriously many years from gas and yet never imagined that they had any, until they saw the results which followed the liberation of the gas.

In treating various kinds of nervous and mental conditions (melancholia, epilepsy, insanity, syncope, vertigo, etc.), one sees the uniform relation between aggravation of these symptoms and the presence of gas. These immediate effects of spinal treatment on the production of gas are most striking, and these results are obtained within limits in spite of the presence of food in the digestive tract. One can hear the gas begin to move and feel the muscles relax. This is of daily occurrence. Treatment brought relief even when a patient was so distended with gas that oxygen was being used to sustain life. Gas often produces symptoms attributed to the liver; for example, one man was having what had always been called a bilious attack; the normal color had left his face and he appeared quite sallow, but as soon as the gas was allowed to escape from the stomach, the pulse came to normal, the color came back to the face, and all of his "bilious" symptoms disappeared within a few minutes after treatment. Bile could not be eliminated so rapidly.

Even in treating an extreme case of eczema, which was ultimately cured, every attack of flatulence aggravated the eczema. Even in view of all of the disturbances caused by flatulence, it does not follow that a patient should be deprived of all nourishment by a too rigid diet, which could only aggravate the nervous irritability. Those with lung trouble are not expected to stop breathing; neither should we expect dyspeptics to forgo food. Insufficient food weakens the nerves to the stomach and aggravates the indigestion. The immediate results which follow the liberation of gas from the stomach or some loop of intestine prove at once that the vasomotor disturbance accompanying the gas is usually the cause of those symptoms which are attributed with unphysiological impartiality to the liver, to constipation, to auto-intoxication, to uric acid or to hysteria. Waste products accumulate and chemical changes occur in tissues whenever the rate of flow of the blood is retarded; but even if

gangrene develops, these "toxins" are not all absorbed from the digestive tracts. To locate the centers controlling the pylorus, the writer a number of times drank a glass of water, and while maintaining loud succussion sounds in the stomach by rhythmic contraction of the abdominal muscles, he began pressing on the spinal muscles innervated from the same spinal segments as the pylorus. Immediately he could hear and feel the water leave the stomach and the succussion sounds ceased.

The presence of gas produces such powerful changes in the circulation that it would be difficult to determine what treatment to give on all the other spinal segments until this disturbing factor has been removed. This rule would apply also if there is gas in the intestines—that the gas controlling areas should be treated first. If the distension of the stomach occurs with hypotension, alcohol must always be applied.

Nausea

Any irritation of the nervous system, if sufficiently severe, may cause nausea, and necessarily the cause must be treated. In any case, the pylorus contracts, and, to relax this, treatment must be given for the fifth to ninth dorsal segments, chiefly on the right side. Prolonged Treatment is usually required, but nausea may result from hypotension and then Momentary Treatment is necessary. The existing hyperemia or anemia of the brain must be relieved also by treating the dorsal segments and abdominal segments. Usually the whole spinal cord is disturbed and requires treatment, but the fourth to ninth dorsal segments are immediately involved in stomach disturbances. Sucking ice, or any quieting treatment, will be helpful; deep breathing may help to stop nausea. Gas formation must be reduced to normal.

Acidity of the Stomach

The amount of acid produced in the stomach depends on the amount of blood supplied to the gastric glands. The condition will therefore require Prolonged or Momentary Treatment according to whether the excessive blood supply is due to active

or passive dilatation of the blood vessels, or, in other words, whether the cord is hyperemic or anemic.

With excessive amounts of flatulence, whether caused by cold, fatigue, food, or mental excitement, the circulatory change to be treated is the existing anemia or hyperemia of the second to sixth dorsal segments, especially on the left side.

This anemia or hyperemia may occur with any of the general acute or chronic conditions of the general circulation, classified in the Summary of Chronic and Acute Conditions of the Circulation.

Class 1. Chronic anemia of the particular segments from general hypotension requires Momentary Treatment (alcohol).

Class 2. Those with chronic hyperemia of the uppermost third of the spine require Prolonged Treatment for upper six dorsal and for the sacral segments (lower third), but Momentary Treatment for the intermediate part of the spine.

Class 3. General chronic hyperemia of all spinal segments requires a general Prolonged Treatment.

Class 4. Those with very irritable visceromotor nerves require Prolonged Treatment to let the gas by constricted parts of the bowel.

Acute Conditions, *Class 3.* General hyperemia from active dilatation of vessels of the cord occurring with any severe illness, as with fever.

Those in Chronic Class 2 (hyperemia of upper dorsal and sacral segments) if exposed to a *slight* cold or other cause of increased hyperemia, require Prolonged Treatment for upper dorsal and sacral segments and Momentary Treatment for intermediate segments, but if the cold is severe, they pass temporarily into Class 3, and require general Prolonged Treatment.

Those in Chronic Class 1 (general hypotension) if exposed to a slight cold, require general Momentary Treatment or alcohol (always alcohol if the hypotension is great) or Prolonged Treatment for the upper third of the spine if a local hyperemia has been produced in the segments controlling flatulence. As patients pass from Class 1 to Class 2, as a result of improved

tone of the blood vessels, they are more and more likely to require Prolonged Treatment for those segments controlling the secretion of gas.

Anemia or hyperemia of the second to sixth dorsal segments or half segments may be responsible for so rapid a formation of gas as to fill all the bowels. Those with high blood pressure but with also a tendency to hypotension in local areas (Class 2) require great care (see Warning 1); also those with general chronic hypotension who have just recovered from an acute attack which for the time being required Prolonged Treatment. The human organism consists essentially of two tubes, the arterial and the alimentary. Contraction or dilatation of part or all of either tube constitutes the most important consideration in most chronic and in many acute conditions. Acute and chronic stomach troubles are so common and so often the cause of other disturbances, that their cures necessarily represent a large proportion of the results of spinal treatment. Undue irritability of the pylorus, because of its effect on the stomach and on the whole circulation may cause or aggravate any nervous symptom, even insanity. A coated tongue is a common result or coincident symptom with contraction of the pylorus, in addition to all the other digestive and circulatory, and therefore nervous, results which follow such contraction.

As in every other condition, the quickness of improvement depends on the vigor of the general circulation and the fatigue of the patient. Some patients had been unable to retain food with any regularity for twelve or fifteen years. As soon as one realizes that the function of every part of the digestive tract is controlled by the spinal cord, it is superfluous to mention all the symptomatic details which can be cured. One patient for fifteen years had always vomited after drinking a glass of cold water; another would become flushed and have a rise of two degrees in the sublingual temperature after a drink of water. The first was the result of extreme irritability of the viscero-motor and the second of the vasomotor nerves, and both illustrate the possible results of drinking cold or ice water. The results will always be in proportion to the irritability of the

nerves involved. Many of the people treated had spines so sensitive that they had been made worse by all previous treatments.

Hiccough

To treat this condition, liberate gas from the stomach, since the spasmodic contraction of the diaphragm is probably usually excited by the pressure of gas; and also give proper treatment for the third to seventh dorsal segments for the diaphragm, or any other segments demanding attention. Steady pressure on the phrenic nerve in the neck may also be helpful. Hypotension requires alcohol. Nothing but cold on the spine can help extreme low tension.

Constipation

Constipation may be the result of varying causes, but most frequently it has been due to a functional weakness of the visceromotor nerve cells, located chiefly in the lumbar region and chiefly on the right side. Anemia from hypotension has been a common cause and this will be overcome by raising the blood pressure and the muscular tone of the bowel to normal by Momentary Treatments, followed usually, after the patient passes into Class 4, by a few Prolonged Treatments to relax the most contracted muscle rings of the bowel. The number and degree of contractions of these muscle rings will depend on the duration and severity of the starvation of this part of the spinal cord during the preceding years of arterial hypotension. More often constipation is due to intestinal hypertension and requires always Prolonged Treatment until the visceromotor nerves become less irritable, and the bowel relaxes.

The spinal muscles innervated from these half segments are often extremely contracted, sometimes feeling almost like bony projections. Prolonged Treatment on these muscles will relax the contracted bowels. The quickness of response, which is often remarkable, depends on the degree of irritability of the nerves. See Warning 1, and never lower blood pressure too much.

In giving treatment it will be observed that just as chill con-

tracts the pylorus, intestines, or cervical muscles, so also it contracts the spinal muscles innervated from the same segments and the constipation is uniformly aggravated simultaneously, and diminished as treatment relaxes these muscles. Further, it was often demonstrated that the symptoms which uniformly had developed, if the patient's bowels failed to move one day, were not the result of absorbed toxins, but were due to contractions of gastric and intestinal muscles with incarcerated gas which so depressed the circulation as to affect the head and produce other symptoms, all of which were relieved before the bowels moved.

Cathartics can ultimately only increase the irritability of the nerves responsible for the condition, and cathartics and enemas will seriously aggravate the cause when there is a general low blood pressure. Enemas may be very helpful for constipation with hypertension of the arteries or intestines. Constipation will result if there is an undue contraction or loss of muscular tone of any part of the lower bowel. This retards the rate of movement of the contents. If either Momentary or Prolonged Treatment is given, contrary to the requirements, over the segment responsible for the constipation, the condition will be aggravated.

Cramps

Contractions of any muscles, skeletal or visceral, not excited by organic changes in the cord or by abscesses or other local irritants, can be relaxed by Prolonged Treatment (Momentary Treatment if there is hypotension) over proper segments. This includes all contractions, as previously stated, from the larynx to the foot. Necessarily, the cause must be treated and all the considerations of blood pressure and the warnings borne in mind. If the nerves of the stomach are extremely irritable and there is great pressure of incarcerated gas or indigestible food, it will take much longer to relieve the attack.

The effects of spinal treatment on all kinds of stomach troubles would certainly confirm, to say the least, the conclu-

sions of Osler and many others who say that serious stomach troubles can exist without an anatomical lesion.

Diarrhea

Most uncomplicated acute attacks of diarrhea have been stopped by one Prolonged Treatment over proper segments. Very commonly these attacks are from cold; this is proved by the fact that in these cases, all of the spinal muscles, even in the neck, are contracted and sensitive. If the trouble is in the lower bowel, there will be frequent movements and the sacral segments will specially need treatment; if in the upper bowel, there may be fewer, larger, and very watery movements and the lower dorsal segments will need treatment. Usually both areas require Prolonged Treatment.

The weakness and "caved-in" feeling during and after an attack of diarrhea is a result of the great vasomotor disturbance and consequent anemia of the brain and cord, and not chiefly to loss of nutrition. This is proved by the noticeable return of strength following a treatment which not only stops the diarrhea but restores the vasomotor conditions to normal. This is a fact of the greatest importance and value.

In diarrhea, in addition to the vasomotor disturbance, there may be an overactivity of the viscero-accelerating nerve centers, but the activity of these nerve centers would be reduced by the same treatment which affects the vasomotor centers, since the vasomotor and visceromotor centers are in the same segments. No astringent or other medication could affect directly the particular segments involved. Incidentally, the treatments have proved that usually the diarrhea with people who are at all careful of the diet, is not the result of some undigested food but that the indigestion and the diarrhea are the result of a vasomotor disturbance following even a slight exposure to cold air. This would explain Dr. Osler's observation that a fall in the temperature of from twenty to thirty degrees, particularly in the spring or autumn, may induce an acute diarrhea in a large percentage of the population. As soon as patients realize that cold causes diarrhea because they are excessively sensitive in

that area, recovery is always much more rapid, partly because the patient would ward off future attacks and partly because nervous patients would cease to starve themselves through fear of food every time an attack occurs. A chill not only may cause diarrhea but if chill may cause an abscess of the leg bones it could surely cause gastric ulcers (see "Modern Surgery," Da Costa).

The disturbance may be controlled by any one or all of the segments, or half segments, from middle dorsal to middle sacral. Each treatment for dysentery makes an immediate reduction in the pain, congestion, and contraction of muscles, but it may be necessary to give two or three treatments in a day for a severe attack. If a patient with low tension has been treated for an acute attack of diarrhea during a course of treatment for something else, the greatest care should be taken not to give a Momentary Treatment until the acute attack is entirely over, because at such a time Momentary Treatment would immediately start a very severe attack.

People with chronic diarrhea cannot be too careful about fatigue and cold. Fatigue will cause diarrhea because any fatigue tires all the nerve cells and especially the weakest cells controlling the abdominal blood vessels. If a patient is sufficiently careful, he can be instructed where and how to press on the spinal muscles so as to stop future attacks.

Incidentally, the immediate effect of spinal treatment on diarrhea and dysentery proves that in many cases the use of purgatives to remove the alleged irritating substances is sometimes a dangerous procedure, which weakens or collapses a patient with hypotension; and even with cases of high blood pressure having limited areas of hypotension, it may add to the congestion of intestinal mucous membrane. Single treatments have stopped, at once, cases of diarrhea of two months' and two years' standing. This was not done by any sedative "inhibiting" or paralyzing action on the nerves controlling the action of the bowels, but by restoring the normal vascular condition of a few spinal segments, and therefore of the bowels. The theory that the diarrhea was due to some irritation and

that it would be undesirable to stop the trouble at once was quickly and absolutely disproved. The use of astringents on congested mucous membranes is undoubtedly helpful for many conditions, but after one has seen that dilated blood vessels can be contracted by spinal treatment the astringent may become of secondary value. Chronic amœbic dysentery has been cured because the amœbæ die out if the congestion of the bowel is cured.

Biliary Colic

In this condition there may be an excessive irritability of all the visceromotor nerve cells, which has persisted indefinitely, even after an operation. This would indicate that in this condition, as in all others, excessive nervous irritability may be independent of any anatomical cause. Spasm of the muscles of the gall duct excited by the passage of a calculus has been relieved by pressure applied over the spinal muscles of the right side controlled by the ninth to twelfth dorsal segments.

"Chronic Appendicitis"

In the cases treated and incidentally cured, this condition may have been due to the incarceration of gas at the ileocæcal valve. This is due usually to anemia of the cord from low blood pressure, but would also occur with high tension. In all these cases of low tension, a few seconds of Prolonged Treatment over *any* lower dorsal, lumbar or sacral segment or half segment would produce a painful distension of the intestine controlled by the segment treated. By reversing the treatment the pain spasm could be relieved instantly. While in Class 1 this condition requires the application of alcohol; when the patient passes into Class 4, Prolonged Treatment will always be required, particularly for cramping of any muscle. For acute attacks with fever, Prolonged Treatment would always be required, though some acute attacks resulting from hypotension will be relieved by a little alcohol. It may seem superfluous to say that an abscess requires an operation, but spinal treatment affords a means of deciding whether an operation is necessary or

not. A single treatment has relieved high fever and great pain, after producing a heavy perspiration.

The Prolonged Treatment must be given to the tenth to twelfth dorsal segments, especially on the right side, paying close attention to the blood pressure conditions, and also to the segments controlling the production of gas. One case of acute "appendicitis," where the patient was fortunately "too weak for an operation," was relieved by a little alcohol sprayed on the spine. This raised the blood pressure 20 mm., and relieved the anemia of the cord. If colitis exists, this is relieved as the vasomotor nerves to the mucous membrane of the bowels recover.

Ptoses

Ptoses of the viscera are due to weakness of the nerve cells controlling the muscles and ligaments. They will ultimately develop after a long continued hypotension of the arteries and even with hypertension, if there is any degree of starvation of the spinal cord. Remarkable results have followed the restoration of the normal nutrition of the cord.

Surgical writers on the subject of ptoses have shown that a factor in the causation of ptoses is the accumulation of venous blood and lymph in an organ; the increase in weight gradually causing displacement of the organ or twisting on its pedicle from a one-sided accumulation of fluid. This would help to explain why treatment to restore the normal vasomotor tone of an organ is a more physiological and fundamental proceeding than the mechanical or anatomical fixation by surgery.

The Heart

As has been stated, the heart action is most commonly disturbed by incarcerated gas and always in proportion to the intensity of the contraction of the gastric or intestinal muscles. Even in cases where the pulse had been intermittent for years, and the patient had been told repeatedly that nothing could be done, as soon as the first treatment liberated the gas by relaxing the contracted muscles, the pulse became regular. Even with

valvular trouble, the actual resistance to the heart action is chiefly in the abdominal blood vessels, and if the circulation slows below normal for any reason, the gas is formed more rapidly and the slowing of the circulation increases the irritability of the nerves which contract the stomach, intestines, and arteries, until the circulation is strangled by this vicious circle, and by the pressure of gas. With hypotension, the heart is handicapped also because the blood is not returned to it rapidly enough. In treating such conditions one should very carefully give a general Momentary Treatment, if there is a tendency to hypotension, or Prolonged Treatment for the segments which are responsible for a chronic hypertension. Even if the slowing of the heart is due to "irritation of the vagus" as a result of "hypertension of the blood vessels of the medulla," the mechanism which controls the contraction of the abdominal blood vessels is immediately responsible for the rise in pressure, and for the "hypertension of the blood vessels of the medulla."

The circumstance that for a number of years treatment for every chronic condition, and frequently for acute attacks, usually brought the pulse to normal in number and usually in quality as soon as the abdominal disturbances were relieved, proves a fact of physiology which is not fully recognized in the literature of the mechanism of the heart. The pulse has come to 72, 66, or 60 in all adults with such regularity that the writer has considered a constant variation of two or three beats as detrimental if not pathological, and usually has continued each treatment until the pulse was at the exact normal for the patient treated. In fact, this is the most important test whether a treatment has been properly given. The blood pressure test does not determine the amount of resistance to the heart action. The blood pressure may be normal and yet the heart may be giving out on account of the extra effort required to propel the blood through certain contracted arteries of the abdomen, or the vessels of the skin alone may also offer great resistance, or the heart itself may be subjected to a great pressure from gas in the stomach.

If treatment is given to relax any abdominal arteries which

already are passively too much dilated, the pulse at once becomes weaker; if the same treatment is applied for segments which control arteries, or gastric or intestinal muscles which are too much contracted, the pulse improves at once or as soon as the arteries dilate toward normal. In the latter case, the pulse improves because the resistance to the heart action is lowered toward normal; in the former case, the rate of flow of the blood is slowed by the diminished arterial recoil or contraction, and the nerve cells in the brain and spinal cord which control the heart action become anemic. No one expects other nerve cells to functionate properly when the rate of their normal blood flow is diminished, and the cardiac centers are no exception to this rule.

It is usually not so much, as is commonly supposed, a question of the condition of the heart, whether the pulse improves from a given treatment, it is more a question of the vasomotor tone in every part of the arterial tree. The heart has no opportunity to recover or to hypertrophy with a diminished rate of nutrition. The heart is only a part of the vasomotor system, the part which gives the initial impulse to the pulse wave. Its nutrition and functional activity depend on the tone of the arteries, especially those of the abdomen. The effect of any drug vasodilator or any general treatment of any kind will depend on how large the area of hypotension or hypertension is, and on which area is most affected by the drug or treatment.

Any drug which irritates the stomach increases the formation of gas and is therefore adding to the oppression of the heart.

Every case of slow, or rapid, or weak, or intermittent pulse which the writer has treated, was due to the gastric or abdominal condition. One case of goiter had a pulse of 115 for fifteen years. It came down thirty-five beats after the first treatment. It proves the enormous value of proper spinal treatment for cardiac conditions to see a patient whose hands and feet are blue from depressed heart action, from extreme abdominal tension, respond to treatment in a few minutes; to see the abdomen relax, the pulse increase in strength, sometimes twenty beats in number, and the color return to the extremities. No

heart stimulant would meet the pathological requirements and no drug to reduce pressure could possibly affect the special segments at fault. Sometimes symptoms which are the result of an incurable condition, *e.g.*, headache from hypertrophy of heart following a valvular lesion, have been cured.

If a man has high blood pressure with weak heart action, perhaps from years of overwork, it is no benefit to lower the blood pressure by weakening the heart action. The high blood pressure is the result of the irritability of the vasomotor centers in the cord and of gas pressure, and this irritability can be reduced only by improving the nutrition of the cord. Therefore a treatment would be beneficial if it strengthened the heart action, even if the blood pressure were temporarily raised thereby. The blood pressure will ultimately be reduced because the improved circulation will reduce the vasomotor irritability. Such cases usually require Prolonged Treatment wherever there are hyperemic areas in the lower half of the dorsal, or in the lumbar or sacral segments. It is also of vital importance to treat the segments controlling the formation of gas (second to sixth dorsal), which is always excessive in amount with high blood pressure.

The results of treating hypertension prove that it is not injurious to lower blood pressure which has been high for years, though this statement is frequently made. Lowering blood pressure with a drug, however, may have serious objections. If a patient has high blood pressure, it is just as necessary and beneficial to lower the blood pressure, if the brain or kidneys are giving out from the pressure instead of the heart. It seems superfluous to add that structural changes in tissues cannot be overcome. Cold and fatigue are dangerous in proportion to the irritability of the nerves, and hypertension represents the most extreme degree of irritability. Several patients, with only a short time to live according to heart specialists, have recovered and lived actively, because the heart was relieved of enormous unnecessary work when the treatment relaxed contracted arteries, intestines, or the pylorus.

Hyperemias, Congestions, and Inflammations

Even when hyperemias, congestions, and inflammations are the result of infection, they are vasomotor disturbances and their recovery depends on the strength of the general and local vasomotor mechanisms even when antiseptic treatment is necessary.

Just as heat, or counterirritants on the spine are recommended in standard medical textbooks to reduce the congestion in pneumonia, Bright's disease, infantile paralysis, or other infectious conditions (no matter whether we consider the congestion as the result of, or the opening for, bacterial invasion), so, also, manual spinal treatment is a similar, and sometimes a much more powerful, instrument for reducing congestion. All the rules for affecting blood pressure must be carefully followed, because Momentary Treatment would greatly aggravate an active congestion and Prolonged Treatment would be most prostrating to a patient in a weak condition. The presence of an infection does not make it less important to control the vasomotor disturbance. The obvious control of the throbbing of the eyeball, or of the toe in gout, or of the thumb, and the control of hemorrhage from various tissues, all prove the enormous value of spinal treatment in the control of congestion of any tissue.

Catarrh

Whether acute or chronic, catarrh of any mucous membrane, from rhinitis to colitis, or excessive secretion from any gland, is due to an acute or chronic hyperemia, due either to temporary activity of the vasodilators, or chronic weakness of the vasoconstrictors; this increase in the amount of blood going to a tissue increases the activity of the secreting cells. When the vasoconstrictors to any gland are weak, the functional hyperemia will be excessive; hence, hyperacidity is common, when digestion is weak, because glands secrete in proportion to the amount of blood they receive. Proper treatment over the proper segments of the cord should be given as required, to relieve the anemia or hyperemia of each spinal segment.

Fever

Fever can be most effectually controlled by spinal treatment. Hot spinal fomentations, keeping the patient warm and perspiring until the fever subsides, is the best method. The spinal segments which control the most congested areas should then be treated with the hand. The pressure of the warm hand should be very gentle, because with fever the nervous system is extremely irritable. Except for an occasional case of extreme chronic hypotension, with fever there is a general active hyperemia. Soothing, persistent Prolonged Treatment is required for the hyperemic cord and brain. The blood vessels of the skin can hold a large proportion of the blood and just as far as these vessels are dilated there will be less blood in the congested cord or other area. There is also an excessive amount of gas, the result of the hyperemia of the stomach.

Congestion diminishes or stops the functional activity of any organ and would, for example, prevent the spleen's manufacturing white blood corpuscles, which destroy the infection, and the congestion of the liver prevents its destroying the toxins in the blood. The response which can be obtained will depend on the nature of the cause, and, like every other symptom, on the degree of irritability of the nerve cells. An infection must run a certain course, but the usual length and severity of the attack can be greatly reduced. Since fever usually terminates with perspiration, whatever conduces to promote the perspiration is helpful, but one should not oppress the patient with too much covering. Obviously, this safe method cannot be combined with cold bathing or exposing the body to cold air. A cold bath is everywhere considered dangerous after perforation of the bowel has occurred in typhoid fever, because the cold drives the blood into any internal congestion. Just as sea bathing may be most beneficial for those strong enough to react properly, but is injurious or fatal to the weak, so also with cold bathing for fevers. The strongest are benefited; the weakest succumb. If the patient is very weak with hypotension and fever exists, as in tuberculosis, alcohol is required for all of the cord. Olive oil on the skin, by helping to reduce the irritability of the vaso-

motor nerves, has been helpful in fevers. Even when infections or other conditions make manual treatment undesirable, the same principle applies, as for example, when Allan Starr recommends mild mustard applications every three hours for the acute stage of infantile paralysis.

Chronic Subnormal Temperature

In all cases treated, this condition was due to depression of the general circulation, complicated with much gas. Each treatment usually brought the temperature to normal, as soon as the circulation was reestablished.

Sore Throat

The immediate complete reduction of soreness and difficulty in deglutition in case of sore throat is most striking. With infectious throat conditions, spinal treatment would be not less valuable. If due to a general cold the entire spine needs treatment; if a local disturbance only, Prolonged Treatment over the second to fourth dorsal segments is required. A slight sore throat with hypotension requires alcohol.

Bronchitis

For bronchitis, give Prolonged Treatment for acute attacks over the third to seventh dorsal segments, and the same for chronic conditions, unless the blood pressure is low. Bronchitis even of many years can be cured, but at the beginning the patient must be extremely careful of all sudden changes in temperature. The cough will be excited by the slightest dilatation of the blood vessels of the mucous membrane. If a patient is weak, the whole vasomotor system must be strengthened before the weakest and most sensitive spot can be cured. The "tightness" of the chest muscles which comes with acute bronchitis, colds, and so on, is always immediately reduced by treatment; vasomotor changes cannot be so rapidly reduced because time must be allowed for the accumulated fluid to leave the congested area.

The Liver

This organ is commonly blamed for symptoms due to con-

traction of the duodenum, or intestines. Lauder-Brunton shows that the size of the liver and necessarily its functions depend on the general blood pressure. Contraction of the duodenum beyond the gall duct necessarily produces nausea and reversed peristalsis, but the liver is not at fault. Sometimes the yellowish appearance of a patient suffering from a "bilious attack" has disappeared during a treatment which relaxed the intestinal and arterial contractions which were responsible for all the symptoms. Jaundice may result from obstructive swelling of the lining of the bile duct and is therefore pathologically, in this condition, a vasomotor disturbance similar to the swelling of any mucous membrane. It may result also from the contraction of some intestinal ring which prevents the normal passage of the bile. Unless the result of organic trouble, either condition could be relieved by spinal treatment.

Malaria

Treatments which were given to typical cases of chronic malaria, where the patient had been warned against taking any more quinine or calomel, proved that, even in this general infection, certain segments only were markedly affected and a few treatments cured the spinal soreness, insomnia, and other symptoms, and greatly helped the general weakness resulting from the condition of particular spinal segments.

Tuberculosis

Obviously, the patient must have the most nourishing food, pure air, and out-of-door life to prevent constant reinfection, but since there is a low blood pressure with most cases of tuberculosis, unless something is done to restore the normal circulation, the lungs have the minimum chance for recovery. It would seem to be an obvious law that it is impossible to restore the normal circulation in a local area if the general circulation is depressed. This law is just as true of any other local infectious irritation. The cold air treatment for tuberculosis is beneficial largely because it cures the loss of vasomotor tone. The digestive and general circulatory disturbances which accompany this

condition could be cured and this would be another large factor in the patient's recovery.

Enlarged cervical glands, nontubercular, respond rapidly; sometimes a single treatment has made a great difference. Spinal treatment for tubercular glands would be a valuable adjunct to control the vasomotor factor. Even when there is a chronic hypotension, Prolonged Treatment may be required, if a patient shows the slightest indication of having taken cold. Never manipulate tubercular glands for fear of spreading the infection. Enlargement of "adenoids," enlarged tonsils, and some kinds of deafness from catarrh of the middle ear are all the result of loss of vasomotor tone of the tissue. Hyperemia produces hypertrophy of tissues and even in cases where removal is necessary, because the adenoids are interfering with breathing, the operation only removes an effect. Adenoid tissue, because it is swollen or congested, does not necessarily require removal, any more than the eyeball. It probably is a tissue having important bactericidal functions to perform. (See "The Tonsils and the Voice," Faulkner.)

After Operations

Spinal treatment is of enormous value in restoring the normal vasomotor conditions which have been disturbed by operations. A single Momentary Treatment may accomplish in a moment what otherwise might require days or months to accomplish. One treatment relieved entirely the soreness of the back and stiffness of the knees which had existed for two months following an abdominal operation.

Piles and Hemorrhoids

These, except the most extreme cases, can be cured by spinal treatment, without surgery, because they are simply the result of weakness of the vasomotor nerves to that part. They are only a symptom of vasomotor disturbance. By steady, gentle, painless pressure over the controlling second to fourth sacral segments, acutely painful, throbbing, and protruding piles have been steadily reduced until complete relief was afforded. Acute paroxysms of pain at the sphincter ani can be stopped by con-

tinuous pressure on the trunk of the nerves between the anus and tuberosities of the ischii. With low blood pressure the application of alcohol to the lumbar segments with Prolonged Treatment for one or more sacral segments has given immediate relief for long-standing cases of hemorrhoids. If the vasomotor nerves are very weak, the application must be repeated until the nerve cells recover strength. If the blood pressure is very low, the alcohol must be applied over the sacral segments also.

Eczema

One most extreme case of eczema of fifteen years and a number of milder cases have been cured. As soon as it has been proved that spinal treatment, given accurately, can restore the normal blood supply and therefore the nutrition of any tissue, it is superfluous to mention all the noninfectious disturbances of the skin and other tissues which have been cured.

Kidneys

Usually such highly vascular organs or tissues as the brain, liver, and kidneys become deranged in function as a result of disturbances in the general circulation and the condition of these organs is not the cause but the result of the circulatory and other disturbances. High blood pressure is often supposed to be the result of chronic nephritis, but in a majority of those treated for high blood pressure the kidneys were unaffected. Acute congestion of the kidneys from cold can be relieved very largely by the first treatment, if the patient had been previously well. Chronic kidney troubles, if the tissue changes were not too great, have been cured; because variations in the function of the kidneys may be entirely the result of variations in the blood supply.

Varicose veins where elastic stockings had been required for years have been rapidly cured. They were the result of extreme loss of vasomotor tone in the leg muscles. Alcohol was usually required.

The results of spinal treatment on such conditions as enlargement of the thyroid, and in diabetes would seem to indicate that unless glands are congenitally defective, or unless the degenera-

tive processes which follow prolonged hyperemia are too far advanced, it is the most fundamental and therefore successful therapeutic procedure to restore to normal the activity of the controlling nerve centers, and the normal vascular condition in the gland. No gland can ever functionate normally unless its blood supply is normal. The severity and duration of the symptoms of milk leg are due to the weakness of the controlling vasomotor mechanisms as well as to the presence of the clot. This was proved by the very rapid reduction in the size of the leg, which could not have been the result of any change in the clot.

Rheumatism

The results of spinal treatment would seem to prove that the irritability of the musculomotor nerve cells, which is responsible for the contraction of rheumatic muscles, is in no way different from the irritability of nerve cells which exists in all extreme conditions. There is also more or less disturbance of the local vasomotor mechanisms. Uric acid deposits may be formed, but they are not the cause of the contractions.

It is certainly most unphysiological to employ mechanical traction to try to straighten joints which are flexed by muscles whose contraction is due entirely to extreme irritability of motor nerve cells in the spinal cord.

Mineral Waters—All forms may be said to be beneficial in gout, as the main element is the water and the ingredients are usually indifferent. Much of the humbuggery in the profession still lingers around mineral waters, more particularly about the so-called Lithia Waters. The efficiency in reality is in the water, in the way it is taken, on an empty stomach and in large quantities; and everyone knows the important accessories in the modified diet, proper hours, regular exercise, with baths, douches, etc., play a very important rôle in the cure.—Osler.

All the cases of rheumatism which the writer has treated were due, if acute, to exposure to cold, usually when fatigued, causing a marked vasomotor disturbance, or, if chronic, they were the result of a general nervous, including, of course, vasomotor fatigue, aggravated by cold. The most extreme cases of

rheumatoid arthritis which the writer has seen were entirely the result of extreme low blood pressure, brought on by overwork. The amount of improvement to be expected will depend on the amount of tissue change. The nervous weakness can be cured and this means usually considerable general improvement.

Back of every rheumatic condition there is a general or local extreme nervous (vasomotor or musculomotor) irritability, making the patient sensitive to the slightest change of temperature. If in health the circulation is a "sensitive equilibrium," in rheumatism the balance is much more sensitive since it is already disturbed, and many people prefer to have rheumatic muscles rather than take necessary care of the weak area. Such people are suffering as a result of overwork or carelessness and the attacks can be relieved by treatments and prevented by care, but not exorcised by pills.

A man will "take cold" most easily at his weakest spot. So the "rheumatic diathesis" may mean nothing but extreme vasomotor weakness of the nerves in the skin, joints, or muscles. Cold, fatigue, excitement, and indigestion all may aggravate any chronic trouble, because they disturb the general circulation.

Those who are inclined to feel despondent over the treatment of an inveterate lumbago would do well to recall the emphatic statement of Schreiber, namely, that his collective experiences justify him in the assertion that every muscular rheumatism, whether acute or chronic, wherever it is located, can be healed by mechanotherapy. Even cases of twenty years' standing are susceptible of the relief of the pain and the complete restoration of function within a relatively short time. Great relief is experienced for a time by the application of the familiar hot water bag.—Kelly's "Medical Gynecology," 1908, p. 240.

"Venous congestion," as it is usually termed, has been recognized by all physicians since the day of Galen as the first condition essential to the formation of the gouty diathesis.—Henry Sewell.

The unfortunate results of ignoring the segmental structure of the body is well illustrated in the treatment of rheumatic muscles, because if a rheumatic muscle can be relaxed by proper

pressure over the proper segments, it follows that much of the customary dietetic and drug treatment is misdirected.

Many people have seriously injured their health by dieting for rheumatism. Since from the segmental standpoint rheumatism in certain muscles is due to weakness of nerve cells in certain segments, it follows that a too restricted diet will weaken all cells in general, the weakest ones in particular, and thereby ultimately aggravate the rheumatism. Any indigestion, by depressing the circulation, will aggravate rheumatism, and certain acids, for this reason, aggravate rheumatism. An excessive amount of meat might increase the uric acid content of the blood but in order to accelerate the rate of nutrition the writer has encouraged the eating of meat.

Any man, if exposed to certain conditions of cold and dampness can get rheumatic muscles, whether he has an excess of uric acid or not.

Lumbago

With this painful contraction of the lumbar muscles from overactivity of the musculomotor nerve centers in the lumbar cord, there is usually more or less infiltration of the tissues from overactivity of the vasodilator nerves. The condition, whether acute or chronic, can be accurately relieved by spinal treatment. In an acute attack, each Prolonged Treatment gives some immediate relief and the improvement will be progressive. Give treatment twice a day until the patient is up. This will require from one to three days. Mental work, or any fatigue, increases tension of muscles by increasing irritability of nerve centers. An attack is usually the result of cold and fatigue.

The uric acid factor is negligible, since spinal treatment makes immediate improvement. This will be demonstrated by noting the great relaxation of abdominal muscles immediately after treatment. If the infiltration is extreme, the sensitiveness to pressure will be also. In such cases, begin treatment by a little rubbing of muscles toward the spinous processes to promote flow of lymph. Or, it may be necessary to hold the hand

very gently and steadily against the spinal muscles until the sensitiveness is relieved.

There is no physiological difference between lumbago and stiff neck, or cramp of any other skeletal muscles, except that the whole circulation is to some extent throttled by the simultaneous contraction of the intestines and arteries controlled by the same spinal segments as the lumbar muscles. Lumbago may result also from hypotension and require Momentary Treatment.

Even when leg muscles have contracted from some bruise or injury to the knee, they can ordinarily be relaxed by prolonged treatment over the proper sacral segments. The erector spinæ muscles supplied from the same segments will be tightly contracted.

Manual treatment for lumbago has every advantage for the patient over acupuncture, cautery, and other forms of violent counterirritation, recommended by leaders in the medical profession, because pain increases nervous irritability. While the principle underlying all treatments for lumbago is the same, the manual method saves the patient's suffering, is more effective, but requires considerably more of the doctor's time.

Lumbago most clearly illustrates the constant relation between the irritability of nerve cells and the rate of blood flow in the spinal cord. The severity and persistence of an attack is in direct proportion to the degree and duration of the vasomotor disturbance. Immediately after a treatment one can see the improvement in the pulse, blood pressure, and muscular tension. The low blood pressure, which so often occurs, is not due usually to hypotension, but to weak heart action, from the increased abdominal resistance, because there is a very great contraction of the abdominal blood vessels and intestinal muscles, simultaneously with the contraction of the lumbar muscles. This is because all of the motor cells in part or all of the lumbar and sacral segments of the cord are irritated by the vasomotor disturbance.

The contraction of the neck or other muscles, caused by severe strains or blows, should be treated as lumbago. The

irritation from a blow on the back may produce the same vasomotor change in the cord as cold does in lumbago, according to the severity of the blow.

Spinal treatment has proved in some cases, where a slight movement of the knees produced a grating sound which could be heard several feet away, that the sound was not due to the dryness of the synovial surfaces or to uric acid deposits, but to mechanical traction of the tightly contracted muscles moving the joint. This was proved because Prolonged Treatment over one or two sacral segments caused an immediate reduction of the hypertension of the muscles and a cessation of the sound. The amount of relief which can be produced at once in strained or bruised muscles, depends on the degree of irritation of the nerves and the tone of the circulation. Since a single treatment has relaxed muscles which had been contracted from two months to two years, it indicates that treatment of the controlling segments greatly reduces the severity and duration of the contractions following accidents. At the same time it diminishes the amount of vasodilatation which a blow inevitably produces. The cramp which had existed three months in a case of tennis leg, was relaxed by the first treatment, and five treatments cured the condition.

As in this case, usually the treatment would need to be repeated a few times and the general blood pressure brought to normal before the nerves controlling the contracted muscles would lose their excessive irritability. This irritability of the controlling nerve centers very often exists before the injury to the muscle occurs, and is the real cause of the trouble, just as people with a tendency to lumbago have usually had irritable musculomotor nerve cells in the lumbar segments.

Stiff neck muscles, from cold, fatigue, or strain, should be given Prolonged Treatment over the fourth to sixth dorsal nerves. One case of stiff neck, which had persisted two and one-half months in spite of local manipulations, was the result of a diving accident. The fact that proper treatment of the spinal muscles, with no manipulation whatever of the neck, relieves a stiff neck, should prove at least that it is not necessary

to manipulate the vertebræ and also that spinal treatment should be physiological and not anatomical.

It is a matter of almost daily experience, in addition to the regular treatment for some chronic trouble, to give immediate relief to some acute symptom by treating some particular segments; for example, stiff neck, lame shoulder, neuralgia, or indigestion. Sometimes patients who have had irritation of the urethra or bladder from cold which had existed for from one to fourteen days have been entirely cured by one Prolonged Treatment over sacral segments. All of which illustrates the exact results which may be obtained by careful segmental treatment. The so-called "growing pains," which the writer has treated, were painfully contracted muscles, whose tension could be easily felt, and were the result of cold. A few moments of Prolonged Treatment for controlling segments relieved the pain at once.

Massaging a sore spinal muscle in the lower dorsal or lumbar region, even if it feels agreeable, would disturb the general blood pressure if the patient were in Class 1 or 2.

Sciatica, Neuritis, Neuralgia

In sciatica and other forms of neuritis or neuralgia, the intense pain of acute attacks can usually be relieved by the first treatment of the controlling segments. Chronic conditions of many years' standing have been cured. For acute neuralgia in the face, except with hypotension, give Prolonged Treatment over the second to fourth dorsal segments; if in the arms, give Prolonged Treatment for the fourth to sixth dorsal segments; if sciatica, give Prolonged Treatment for sacral segments. For those in Class 2, alcohol is required for the lumbar region. Usually these attacks are the immediate result of cold, especially when one is suffering from nervous fatigue, and a large part of the spinal cord requires Prolonged Treatment. If the blood pressure is low, Momentary Treatment is required. Keep the blood pressure as near to normal as possible by appropriate treatment of lower dorsal and lumbar segments. If facial neuralgia is from decayed teeth, necessarily spinal treatment

could not relieve it; otherwise the complete relief afforded from this extreme suffering is one of the most wonderful demonstrations of the possibilities of spinal treatment. If the back is very sensitive, begin manual pressure very gently, otherwise the pain will be increased. If the neuralgia occurs in the same nerve regularly, a patient may be instructed where to press on the spine to stop it, but if the attack comes from a cold, a general treatment is required.

Lumbago and sciatica often occur together, and for a very obvious reason, since nerves to the two areas start from the same segments of the spinal cord. If sciatica is the result of many years of nervous overwork, although the acute attack can be quickly relieved, the chronic condition cannot be cured until the whole nervous system is simultaneously restored to normal. Acute attacks of lumbago and sciatica may be relieved with mechanical certainty. If due to hypotension it may require only a few seconds of Momentary Treatment.

Spinal Curvature

When not due to tuberculosis of the bone or other destruction of the tissue, spinal curvature responds readily to proper manual treatment, except of course where ankylosis has occurred.

No treatment for weak muscles has ever been devised so utterly irrational and absurd as the prevention of all movement; and neglect of all treatment for lateral curvature does less harm in the vast majority of cases than immobilizing the spinal muscles by braces and supports. The muscular nutrition in these cases is to be restored.—Da Costa.

Most treatment of spinal curvature is anatomical. The trouble is physiological. Muscles contract sometimes with incredible force—and draw the vertebræ out of their normal position, but this is due to excessive or unusual irritability of the nerve centers controlling the opposing muscles. The vertebræ are not to blame. The muscles recover tone and the spine straightens as soon as the nerve centers recover their normal irritability. Excessive irritability can be reduced only

by improved nutrition. The nutrition of the spinal cord depends on the state of the circulation. To explain the apparent anomaly that contracted lumbar muscles usually draw the body forward instead of backward, note the attachments of the quadratus lumborum muscle. The contraction of this muscle overcomes the pull of the erector spinæ muscles and draws the body forward.

Locomotor Ataxia

An exact method of maintaining the sensitive vascular equilibrium of the spinal cord affords a valuable method for the restoration of whatever cells are alive in all forms of paralysis from degenerative changes, whatever the cause. Of course nothing can be done for dead cells. For locomotor ataxia, paralyses, scleroses, and other progressive degenerations of the cord, give Momentary or Prolonged Treatment, according to the pulse, blood pressure, and other requirements. Except in the advanced stages, treatment has stopped the progress of the disease and made some improvement, often considerable, the results depending on the number of cells which are alive. To make as much improvement as possible, treatment should be continued several months regularly and at longer and longer intervals afterward for perhaps two years. The considerations in the sections on fatigue and cold apply particularly when the nerve cells are weakest.

CHAPTER VI

COLD AND FATIGUE: SOME EFFECTS OF COLD AND FATIGUE ON THE HEALTH OF THE NERVES*

Cold

There are two methods everywhere used for affecting the general circulation, both for acute and chronic diseases. One, the use of cold air or cold applications to the body; the other, the use of warm air or warm applications. Sometimes such applications are combined in one single treatment, but in that case it is the application last used whose effect is most lasting and most to be considered. The use of cold is more popular, especially in scientific circles. For those with low tension of the arteries, cold which contracts the blood vessels has produced the most striking results.

Even in those with some degree of hypotension, if the heart is strong enough to react to the stimulus, cold baths and cold air greatly accelerate the circulation. The cold method, however, produces a great strain on the heart. Babies are better when subjected to the incubator method, so also are weak and old people. The warm method, if properly applied, is more effective and perfectly safe even for stronger people. More soldiers survived measles, influenza, and other infectious fevers when kept warm than when kept cold.

The blood vessels of the skin can contain about one-quarter of all the blood in the body when they are actively dilated. Just so far as they are dilated, there can be less blood in any congested organ of the body. If used injudiciously, heat may dilate the cerebral vessels, or cause more flatulence by dilating the gastric vessels. Any farmer or trainer would keep a horse, cow,

* Copyright, 1919.

pig, or chicken warm, when ill. Any sick animal naturally tries to keep comfortably warm.

Since the circulation of the blood is constantly influenced by the temperature and humidity of the air, it is of vital importance to know why and when these circulatory changes are beneficial or injurious generally and locally. Excessive humidity greatly increases the effect of both heat and cold. The amount of change in the circulation produced by heat and cold depends on the degree and suddenness of the temperature change, the humidity of the air, the amount of perspiration at the time, and the irritability of the vasomotor nerves in general or in local areas.

When cold air or water strikes the surface of the body, the external blood vessels contract and the blood is driven inside the body, especially into areas where the blood vessels have the poorest tone. If the vasomotor nerves (which control the circulation) are weak or irritable, a slight temperature change may produce the greatest fluctuations in the circulation. A mild cooling of the skin, especially of the spine, will first dilate and then *contract* the *internal* blood vessels. If the tone of the blood vessels is good, people react to cold baths; weaker ones do not.

Hot baths and hot weather dilate the blood vessels, especially first the external, but also the internal. The internal vessels relax quickly if the tone of the blood vessels is poor, or in any one if the heat is intense. If the nerves controlling the blood vessels in a local area, as in the head or in any organ, are very weak, cold or heat may produce local changes before general ones are produced. For example, those with high blood pressure are benefited by hot weather, which relaxes the blood vessels. If, however, the cerebral vessels have a poor tone the heat may have a bad effect on the head which outweighs the effect on the rest of the body. The old rule, "Keep the head cool and the feet warm," is valuable, because it helps to maintain the normal balance of the circulation. Moderately cool air is very beneficial to most conditions. Cold air and baths are injurious for those with high blood pressure because cold

contracts the arteries. Those with relaxed arteries are worse in hot weather and are benefited by cold air. For example, those with pulmonary tuberculosis, which is usually preceded by and is often the result of low blood pressure, have been commonly cured by cold air and living in an altitude, because cold and altitude both contract the relaxed blood vessels. The benefit is due more to the improved circulation than to the air breathed.

Experiments on men inclosed in air-tight cabinets have proved that it is the temperature and humidity, rather than the lack of oxygen in "bad air," that affects people unfavorably, and these effects are produced chiefly by way of the nervous system from stimulation of the nerve endings in the skin. Few people realize how many acute and chronic illnesses are due to cold. In giving treatment to control the circulation one has exceptional opportunity for observing the effects of cold. Most people think they are not harmed by cold unless they have rhinitis or bronchitis. However, the activity of all the spinal and cerebral nerve centers varies constantly with every variation in blood supply, and change of temperature is the commonest cause of variations in blood supply; hence, any chronic condition, from a rheumatic muscle to flatulence or mental depression, may be aggravated by exposure to cold in general, or more particularly sudden cold or a draught. Commissioners of Labor have published bulletins for the benefit of workmen, showing that exposures to draught or cold, especially sudden cold, produce rheumatism, neuritis, Bright's disease, colic, diarrhea, pneumonia, catarrhs, deafness, and other diseases. If the strongest workmen need to be careful, it is not less necessary for brain workers and especially for those who are sensitive.

It is also an obvious and very serious mistake to attribute these diseases to auto-intoxication, uric acid, or even to microbes, which invade the organism *after* chill has disturbed the circulation. Farmers have found that pigs cannot be successfully raised in concrete houses. The concrete houses are too cold for the pigs' health. Modern institutions for children are being built of concrete and sometimes the children are expected

to play and sit on the cold floors. Hospitals for the sick are also made of concrete.

If a baby chick is chilled it develops diarrhea and dies; when a human baby has the same trouble and dies it is called "summer complaint," and attributed to the microbes in the milk. After a race horse has been exercising it is covered with a blanket and leggings and made to walk slowly for half an hour. If it is allowed to stand it stiffens from the cold. A professional baseball player will put on a sweater after exercising. Many people, however, when warm from exercising, will sit in an open trolley or auto in forced draught, and then attribute any resulting illness to infection, auto-intoxication or heredity.

Chill Helps Germ Development

In Great Britain, the leading medical authority on the circulation of the blood, Lauder-Brunton, says: "Nothing predisposes more to the invasion of micro-organisms than chill." An eminent authority on surgery says many people have gotten abscesses of the leg bone from going down cellar in the summer to cool off rapidly. If even the most deadly pus-forming microbes obtain entrance into the body as a result of chill, it is obviously infinitely more important to learn how to avoid chilling the skin than to pay all the attention to ever-present microbes.

Anyone can get influenza or pneumonia in the summer time from a sufficiently sudden cooling of the skin. Contracting the blood vessels of the skin forces a large amount of blood into the interior of the body. Wherever the blood vessels of the mucous membranes or lungs are most relaxed, there congestion is produced and the microbes can enter and multiply. Therefore, for people to depend entirely on masks and gargles, even the most irritating and injurious, to prevent influenza, and at the same time sit in cold damp rooms without sweater or overcoat, is "straining at a gnat and swallowing a camel."

Seventy-five years ago, when houses were cold, people required heavy flannels, coats, and sweaters. When houses and offices became heated, and often overheated, people were

obliged to abandon heavy underwear to avoid being overheated and taking cold, when going out of doors, from too sudden cooling of the skin. The discovery of micro-organisms should not cause the public to abandon entirely their intuitions and instincts, because any dog or pig tries to keep warm if not feeling well. It would show a little more intelligence to keep warm just in time to prevent getting ill. It is easier to watch one's clothing than all the microbes.

If one has even a slight congestion of any mucous membrane, to sit in a draught on a train or trolley is to ignore the instinct of even the lower animals. The particular microbe which develops in the resulting congestion is a secondary consideration. If college boys are drilled in the rain and then sit and study in wet clothes, the resulting pneumonia should be blamed to the chill and not to the ever-present germs. If those attending the sick are chilled in the sick room, the germ should not receive all the blame for the resulting illness.

Some epidemics are spread by biting insects. Dirt is then the cause of the plague. The inevitable historical triad, "war, famine, pestilence," proves that lowered vitality from insufficient food may be the cause of any plague. Mushroom spores lie dormant in the woods for a year until a wave of air of a certain temperature with a certain degree of moisture arrives, then the spores multiply by the billion. Similarly spores may sometimes lie dormant in the body for years. When the body vitality is lowered by fatigue, and cold produces a disturbance in the circulation, these resident, or any newly arrived germs may multiply with fatal rapidity. More attention to cold and fatigue, which enable the germs to enter the body, would save many lives.

Importance of Care and Protection

It is considered prudent, necessary, and humane, to protect every valuable horse and cow from extreme fatigue and cold, and some even of the most ignorant men will use the greatest care in their treatment of a valuable animal. They do not try to subject the animal to a toughening process to determine what

are the extreme limits, short of death, of the animal's endurance of fatigue and cold. Similarly, if a man is "as strong as a horse," it should not be considered undignified or unmanly to exercise, for the preservation of his life and usefulness, at least a small part of the care required for the less sensitive lower animals.

It is not heroic, or a sign of superiority, when a man sits down with wet feet or clothing, or sits in a draught when warm, or drinks or eats heartily when chilled or hot or exhausted. It is simply a method of determining just at what point he will become ill or die. It is like testing a doubtful mushroom by eating it. Constant maximum tests of the resistance of one's circulatory apparatus to fatigue and cold make for inefficiency and death, whereas the most ignorant mechanic is supposed to try to keep any machine in a condition of greatest efficiency for the greatest length of time.

The protection afforded by a strong vasomotor tone is not essential to the indoor life and indeed may be disadvantageous; on the other hand, house-bound persons are exposed to dangerous congestions when they carelessly take their low-toned vascular areas out of doors. —"Vasomotor Relations," W. T. Porter.

All invalids, and all people with any local chronic trouble, even when the general blood pressure is normal, have some low-toned vascular areas, and when more blood is forced, by exposure to cold, into these weakest areas, any chronic trouble is aggravated. Enuring the skin to endure cold and thereby toning up the circulation has cured many invalids, but it may also increase or prolong any chronic trouble.

Since the amount of disturbance produced by exposure to cold depends on the degree of irritability of the vasomotor nerves, if one has irritable nerves he cannot make other people's endurance a standard of his own. If he tries to do this he will certainly suffer as from any other presumption.

Even in the hottest weather cold may be the cause of the most serious illnesses. Cases of heat prostration may be the result of a previous chill which had contracted the abdominal blood vessels and intestinal muscles and had throttled the

general circulation, thereby reducing the resistance to heat to the minimum. If one is nervously tired he cannot have the resistance of an Indian or a woodsman to cold, though living out of doors is the quickest way to raise blood pressure and increase one's resistance to cold. Many weak people keep themselves fatigued by trying to follow some popular fad, as, for instance, going without sufficient clothes in the coldest weather. It can be done, but perhaps at the expense of wasting nervous energy, or acquiring an undesirable high blood pressure or aggravating or perpetuating some chronic trouble.

People with high blood pressure and neuralgia or some other chronic trouble, may make much better progress by keeping warm until they are well; then they may be able to endure what is expected of some invalids. The weakest organisms, weak babies, can survive only in an incubator. Very sensitive nerves must have unusual protection, and the forced draught to which one is subjected in an automobile or motorcycle is a new and popular means of disturbing unstable circulations and thereby acquiring or aggravating any acute or chronic disease. Even in summer time, especially if one happens to be perspiring, this sudden forced draught may make the most powerful circulatory changes. The strongest workmen get abdominal cramps in this way from the motorcycle. The windshield of the automobile is especially contrived to bring a draught on the back of the neck, the most sensitive and vulnerable spot in most people. The safest ventilation for an auto in winter is to have it closed tightly on all sides except the front. This gives unlimited fresh air with the least draught. Of course few people are ready to believe an auto could be injurious, so that the "rheumatic diathesis" or "auto-intoxication" will be more popular diagnoses. Those who have lived in the tropics know the possibilities of taking cold even in the hot season, and the native with no clothing is safer than the European with damp clothes. Unless humidified, the air in houses heated by steam or hot water is very dry. The resulting dryness of the skin causes one to shiver, perspire, or take cold from slight variations in the temperature.

Damp or snowy air is far more chilling than the thermometer indicates, and few people prepare sufficiently for such weather. Almost everyone realizes that, for those who are fairly well, ocean bathing may be made most beneficial, but if one is weak, the shock of the cold may produce serious results, because the blood is always driven to the weakest spot. This is just as true of cold air. It may be most beneficial, but one may be so sensitive in some part of the circulatory apparatus that the slightest change in the temperature of the air will aggravate any chronic trouble, and the slightest exposure to cold may cause serious acute troubles.

A cold bath would be dangerous or fatal after hemorrhage from the bowels from typhoid fever, because the blood would be driven to the dilated blood vessels. Similarly, people with hypotension may not "react" from a cold bath because the abdominal blood vessels are too relaxed, and any chronic nervous trouble would thereby be aggravated. A hot bath is usually beneficial and encourages relaxation and sleep for those with hypertension of the arteries or visceral muscles. But if the heat dilates the cerebral blood vessels or the gastric vessels and increases the amount of gas, before it relaxes the other arteries and visceral muscles, any amount of restlessness and distress may be produced.

Cold the Cause of Many Chronic Diseases

No one can question the benefit of "fresh air," but the most difficult individuals to cure are those who are constantly aggravating some chronic trouble by ill-considered attempts to get "fresh air." Too much clothing makes one more and more sensitive to cold, and is therefore dangerous and very weakening, especially to those with low blood pressure, but it is also true that no one can go to the North Pole in a linen suit. Each one, therefore, must find the "golden mean" for his condition. While cold air is almost always beneficial for the lungs, the strongest cannot endure sudden extreme changes of air blowing upon the skin. Those who are very weak can stand very little. It is not safe for any invalid, or for anyone with a weak local

area of the circulation, to get out of a warm bed and dress in a very cold room, unless he can vigorously rub the skin first and avoid lingering in the cold even when dressed. Babies must be protected, and so must those whose ears, nose, stomach, or any other tissue has loss of vasomotor tone, or whose controlling nerve centers are very irritable.

Most people do not understand the relation between deafness, neuritis, rheumatism, indigestion, and other chronic troubles, and carelessness or ignorance about exposure to cold. Those who have bronchitis, neuralgia, or kidney trouble soon see the relation between chilling the skin and an aggravation of the chronic trouble. This law is just as true of any other chronic weakness, because, for instance, the digestive organs are just as easily affected by cold as the bronchioles in chronic bronchitis, but it may take a day or two for the abdominal disturbance to become sufficiently aggravated to cause serious digestive, cardiac, or other symptoms. As long as aggravations of chronic troubles are attributed exclusively to toxins, uric acid, heredity, or are simply called "rheumatism," "neuritis," or "indigestion," and are not attributed to fatigue and cold, the patients will continue to suffer from their own carelessness or from their own or their adviser's ignorance.

Just as gypsies, or perfectly well men who have lived out of doors, will feel smothered when first trying to sleep indoors, so some people become abnormally dependent on "fresh air" to the detriment of some chronic trouble. Civilized life is a series of compromises, and extremes are dangerous, especially for the weak. The strongest people have the greatest resistance to fatigue and cold. Some of the warnings given herein were written for those who were recovering health and who wished to maintain the best circulation possible. If the blood is flowing constantly at a rapid rate through the brain and spinal cord, the nerve cells have the best chance to recover. If the circulation is poor, the nerve cells starve out and become weaker.

Effect of Cold on Blood Pressure

People with low blood pressure, or a high blood pressure with

contraction of the cutaneous blood vessels and hyperemia of the head from a lack of tone in the blood vessels of the head, feel heat much more than other people, and because the head feels hot they make every effort to get into cool draughts. Consequently, because the abdominal vasomotor nerves and the nerves to the stomach are exquisitely irritable, they are affected by the cold and the general circulatory disturbance is aggravated and also the hyperemia of the brain. The cramps and other more serious consequences produced by the cold may even be attributed to the hot weather. Anyone whose vasomotor nerves are sensitive will be affected by a draught just as quickly as anyone with neuralgia or bronchitis, but if the blood vessels with the least resistance happen to be in the abdomen no local sensation is felt. But this increased dilatation of the abdominal vessels will aggravate inevitably any nervous or mental trouble, due to anemia of the brain. It may increase the size of a tumor, or it may, at once or more gradually, aggravate any symptom whatever. In this way many people are keeping themselves sick in the effort to get "fresh air," which under proper conditions would be most beneficial.

Too warm clothing is debilitating, not only on account of its relaxing effect on the cutaneous vessels, but just as hot weather lowers blood pressure in those with low tension by relaxing the abdominal as well as the cutaneous blood vessels, so warm clothing, as for example a fur coat in a warm car or room, may in a few minutes relax the abdominal vessels and cause any nervous symptoms, even fainting and nausea, in those with low blood pressure.

Sometimes cold will affect exclusively the visceromotor nerves, causing, for example, intestinal cramps; other times the musculomotor centers are affected, causing contractions of skeletal muscles; other times the effects are chiefly vasomotor, and sometimes exclusively the vasomotor nerves supplying the joints; sometimes cold affects the sensory nerves, causing extreme ticklishness of spinal muscles. Usually it is some combination of these effects. With people who are reasonably careful of their diet, indigestion is commonly the result of the dis-

turbance of the digestive mechanisms, caused by cold or fatigue. As Osler says: "A fall in the temperature of twenty to thirty degrees may induce an acute diarrhea, the result of cold or chill."

Bad Effects of Too Much "Gas"

In perfect health gas in the digestive tract causes little disturbance, but if there is a general or local irritability of the nerve centers to the stomach or any part of the intestines, the irritation from the pressure of the gas causes undue contraction of the gastric or intestinal muscles. This incarcerated gas disturbs the pulse and the blood pressure in proportion to the amount of gas or irritability of the nerves. This is proved by the immediate return of the pulse and blood pressure to normal as soon as treatment relaxes the contraction. This irritability of the nerve centers may be the result of fatigue, excitement, cold, or any illness or mental shock which had previously depressed the circulation.

Under ordinary conditions the most common cause of temporarily increased tension of the gastric or intestinal muscles is cold or fatigue, or both. The resulting depression of the circulation then aggravates any chronic condition whatever. Sometimes, for this reason, the attempt to get a little fresh air by sitting, standing, or walking without sufficient clothing will so slow down the circulation that one will get less oxygen for hours or days afterward than if one had stayed indoors.

A great many chronic conditions are entirely the result of an indefinite repetition of exposures which maintain or increase an existing disturbance of the normal sensitive vascular equilibrium in perhaps a single spinal segment. The dress suit has caused many colds in winter. Standing in the cold, when cold and tired, instead of walking or waiting indoors for trolleys and trains, has caused many illnesses.

Danger of Getting Wet Feet

A wet cloth wrapped around a jar of water placed in a tropical sunshine will chill the water by superficial evaporation until

it becomes very cold: hence the danger of standing or sitting in wet bathing suits or damp clothing or with damp shoes. This contracts the blood vessels of the limbs and forces the blood, which is always under considerable pressure, to the upper part of the body, especially to the weakest place. It is not the dampness of the stockings which is so dangerous, if the shoes are dry. A person may sleep with safety in a wet pack if warmly covered. This explains also the danger of low shoes and thin stockings in winter. This cooling of the skin and consequent contraction of external blood vessels will produce in anyone, if continued long enough (more quickly in the weak), some internal congestion. If in the lungs, it may result in consumption or pneumonia; if in the throat, diphtheria; because the appropriate microbe is usually present waiting for a favorable opportunity to multiply; it may be bronchitis or tonsilitis, or affect one wherever one has a weak point. If the congestion is in the bowels it will be diarrhea; if in the kidneys, Bright's disease. It may be neuralgia, neuritis, or one of the inflammations of the spinal cord. Jaundice may be caused by the cold congesting the mucous membrane of the bile duct. If one has kidney trouble, "standing in a draft of air for a short time, thrusting the arms or feet into cold water will bring on an attack of hemoglobinuria or albuminuria (blood or albumin in the urine) in a few minutes."—Lazarus-Barlow.

Getting into damp and cold beds has made life-long invalids. One throat specialist says that a frequent cause of true croup, if not the chief one, is the vicious method of leaving children partly undressed to show off their pretty necks, shoulders, and legs. Acute and chronic catarrhal deafness is commonly caused by exposure. A slight draught even on an otherwise healthy person may cause complete deafness by congesting the mucous membrane of the Eustachian tube and middle ear, if there is a vasomotor weakness in that part. Many people with chronic diarrhea become afraid to eat most foods because their attention is directed too much to the food instead of to cold and fatigue as the cause of the acute attacks.

Some Effects of Careless Exposure

Many people are suffering constantly from attacks of rheumatism because they do not protect themselves from cold, which always affects the muscles where the nerves are weakest. Returning from Florida too suddenly into cold winter weather has caused many serious and some fatal illnesses. Unless one is strong, it is impossible for the vasomotor nerves to maintain a stable circulation in so sudden and extreme a change in temperature. Riding in a Pullman sleeper has caused many serious attacks, sometimes because of the strong draughts, frequently from too rapid cooling after being overheated. The sudden chill of leather-backed chairs or couches, especially if one is warm from walking, may cause serious illness.

Even on a hot day, unless the temperature is above 94 degrees, the air is colder than the skin, and a draught of any temperature on a perspiring skin chills it. To give animals experimentally in the laboratory a thorough cold, they are heated and then suddenly chilled; hence the danger of sitting in the cellar or other cool place when warm, or going from a hot kitchen and sitting on the porch, or even into a cooler room. When one is exercising and so keeping up a vigorous circulation there is little danger. Also, if one is very vigorous he may have survived many of these exposures, but this does not affect the absolute physical certainty of the preceding laws of nature. A man can have only one fatal illness, and wise men learn from the experience of others.

When one is most relaxed, as upon waking, or also very tired, the greatest changes in circulation will be caused by sudden exposures to cold. Also people suffering from facial neuralgia, catarrh, ear or other head trouble should not sleep in the coldest air without some head covering, because trouble will result from the sudden exposure of one side of the head to a zero temperature, by turning over in bed, after having kept that side at a temperature of 95 degrees. One should keep warm during sleep. Lifelong rheumatic and other troubles have resulted even in the strongest people from sleeping in a draught.

People who wear furs or mufflers must not leave them off until

the cold season is over. The skin becomes accustomed to a certain amount of protection, and a sudden change is dangerous. If one is sensitive, leaving off the smallest amount of clothing before a warm day comes may be dangerous. It is not safe to lean against a cold wall or sit with the back against a cold trolley-car window. Sleeping in a hammock without sufficient covering has caused many serious troubles because one has less resistance to cold when asleep, and the hammock is not thick enough to protect the spine. Getting out of bed in the night to go to the bathroom in cold weather without sufficient protection will cause or maintain many chronic troubles, because one is warm and relaxed and has therefore the minimum resistance to cold.

How to Overcome Effects of Cold

If one is strong enough to react properly, cold bathing will give the maximum resistance to cold; if one is weak, the skin may be toughened gradually by applying with the hand, and to limited areas, if necessary, either alcohol or water slightly cooler than the skin. In any situation where one is likely to take cold slow deep breathing will so accelerate the circulation as to be a great protection. Contracting opposing muscles throughout the body, even while sitting still, will also accelerate the circulation. It would follow as a corollary to the effects on the circulation produced by heat and cold on the spine that it is important to protect the spine with at least as much clothing as the rest of the body, especially in winter. In an emergency, paper put on the back under the coat may take the place of an overcoat. Extra clothing on the spine gives the maximum protection with the minimum risk of overheating. A vest should not be thinnest on the back. Many chronic coughs and other disturbances have been relieved by an extra layer of thin flannel covering the whole back. It can be fastened over any garment.

Since the primary effect of cold is to cause a contraction of external blood vessels and a consequent dilatation of internal blood vessels, especially where the vascular tone is poorest, the application of heat to the exterior of the body, but chiefly and

primarily to the spine, is obviously the quickest way to restore the normal circulatory equilibrium. The severity of the "vasomotor spasm" produced by chill is in proportion to the fatigue or irritability of the vasomotor nerves and may last one day, or for a lifetime. The more quickly one can reestablish the normal circulatory equilibrium by heating the spine, the less chance for any congestion to result, or any subsequent infection to develop. Manual pressure or friction is more powerful than heat, but if the back is too sensitive for any pressure, as when there is considerable infiltration of the tissues, the use of the hot compress is very effective in relieving the spinal sensitiveness and the congestion of the spinal cord. The compress should be carefully applied to the whole spine and covered with a dry blanket, with the warm water bag on the outside. Applying olive oil to the skin of the back is very helpful, because it reduces nervous irritability.

How and When to Apply Heat

This balance between the blood supply of the internal organs and the blood supply of the skin and muscles is a partial explanation of the effect of a great many old-fashioned and homely applications of heat and counterirritation to the surface of the body, as well as of more modern methods. The pneumonia jacket, mustard and capsicum applications to the back and chest, cupping, and many other methods of dilating the external blood vessels are recommended in standard medical works.

The most universally useful method of treatment for all acute febrile conditions is the heating of the body as a whole, and the spine in particular, by a method least irritating to the patient until a copious perspiration is produced. Some perspiring should be maintained until the fever is gone. The more blood is drawn to the skin and to the muscles of the outside of the body, the less there will be to congest any internal organ. For a great many slight chills and local acute attacks, the comfortably warm hot water bag or electric pad, or mild counterirritant, is very beneficial if placed on the part of the spine

which controls the affected area. The hot bag, however, is not only injurious for those with chronic hypotension, but for those with great contraction of the intestinal or gastric muscles, because before the heat will relax these muscles it may dilate blood vessels in sensitive areas, as in the head or stomach. This would generate more gas in the stomach and cause any amount of general disturbance.

Care of Hot Water Bags

Boiling water should never be put into a rubber bag. Do not much more than half fill the bag and carefully press out the steam. This makes the bag softer.

After using the bag, drain out the water, let it hang bottom side up for a little while, then take it down and with the mouth blow a little air into it, just enough to keep the sides from coming together.

Never fold a bag after it has once been used.

A flannel bag covering for the rubber bag is very useful. Metal bags are more durable.

Fatigue

The most frequent predisposing cause of all kinds of illness among conscientious people is living beyond one's daily physiological income of strength. This may be persisted in for years before some organ or tissue gives way. Whichever organ or tissue first gives out is then usually blamed and treated as the cause of the nervous condition. Many people who would not overwork a horse take pride in destroying their health and usefulness. Extra sleep is the remedy for fatigue. An extra hour of sleep in each twenty-four would in a week add a whole night's sleep and would save many from spending several years in a sanitarium or as a care to family and friends at home, or from premature death.

A man's daily income of physical or mental strength depends chiefly on his food, sleep, and the rate of flow of his blood. Some men have a much better circulation than others, and exercise is the chief factor in maintaining a proper circulation.

A man with a poor circulation cannot endure as much fatigue, cold, or excitement as a stronger man; if he attempts, through ignorance, pride, ambition, or a sense of duty, to work as many hours as the stronger man, he will ruin his health. It is exactly like a poor man trying to expend as much money as a rich man. Sooner or later bankruptcy arrives. By economy of strength, a weak person may reach a point where he has an average normal income, but until that time arrives he must be careful.

The Nature of Fatigue

Physical exhaustion is nervous fatigue. The substance of the nerve cells in the spinal cord and brain is consumed by every thought, by every act, by every sound heard, by every object seen, by every sensation, but in particular by every act of the will.

In health this material is replaced by the nutrition brought to the cells by the circulating blood, but especially during sleep.

All fatigue is essentially brain fatigue, hence a man exhausted from mental work cannot at once endure as much physical exercise as another man. Mental work produces the greatest degree of fatigue.

Usually fatigue affects first the muscles, then the spinal centers, and lastly the brain. When the brain is exhausted a man's last reservoir of strength is gone. Fatigue is fatigue, whether from mental or muscular effort. Exercise should be stopped when the muscles are tired and before the nerve cells are fatigued. Those whose brains are fatigued always recover more slowly from any disease than manual laborers. For most men there is less danger of muscular overwork than of mental overwork, because the exercise improves the circulation and therefore the nutrition of all of the body. Muscular work produces also a sense of fatigue and a tendency to sleep, whereas mental work may prevent or disturb sleep.

If a patient with hypotension exercises until the blood pressure is still lower, the exercise may have done harm rather than good, because the circulation is poorer for an indefinite time after.

If a fall in blood pressure is produced by fatigue, the rate of circulation and therefore the rate of recuperation is retarded in proportion to the fatigue. If the fatigue is very great and brought on repeatedly either by mental or muscular work, any degree of neurasthenia with a chronically low blood pressure may result. If the blood pressure is low, even a long night of sleep fails to rest the patient.

Tests of Fatigue

Repeated tests of the blood pressure, pulse, and of the degree of irritability of the nerve cells are invaluable in testing a patient's endurance. Without physical tests no one can intelligently advise a patient how much exercise to take. Many people have been seriously injured by the amount of exercise prescribed.

Moderate, methodical work is more beneficial than excessive or irregular exertions. The ascent of a tower of steps with a high tread causes much more fatigue (that is, requires more metabolism) than ascent by steps with a low tread.

Work performed by a muscle when it is already fatigued is much more exhausting than a greater amount performed when it has been rested. This shows the importance of breaking work up into short periods. By alternate periods of rest and activity one can accomplish much more with less fatigue than by working the same length of time in longer stretches.

A sluggish circulation soon causes symptoms similar to those of fatigue, while an abundant supply of blood rapidly refreshes the muscle. This explains the rested feeling many people have immediately after treatment has restored the normal circulation.

Normal Circulation Vital to Recovery

Too prolonged rest, as in the "rest cure," may be very weakening, because the circulation and therefore one's rate of nutrition are greatly impaired.

For the same reason any support which relieves a muscle from work is weakening for the muscle. This applies to spinal supports, corsets, and sometimes even to eyeglasses.

On the other hand, too much work thrown on any muscle may so irritate the nerves involved as to affect the whole nervous system; *e.g.*, strain of the eye muscles causing headache, or the strain on various muscles causing backache, as from high-heeled shoes.

Even flatfoot may be the result entirely of fatigue from too much standing which exhausts the calf muscles which assist in maintaining the proper position of the foot.

Standing causes more fatigue than walking; partly because standing requires a steady (tonic) contraction of certain muscles and tires nerve centers which must send a steady stream of impulses to the contracting muscle; also the heart action is slower; also the return of venous blood to the heart is not accelerated by the contraction of abdominal and other muscles. Hence, the blood supply to the nerve centers is not so rapid, especially if one is at all tired or weak. Anemia of the brain produces a sense of fatigue, whether the anemia is caused by gravitation, cold, or depression of the heart. With low blood pressure from hypotension, standing is very exhausting because gravitation may produce any degree of cerebral anemia.

If a normal man's grip is tested before and after he takes a long walk, it will be found that the fatigue from walking has somewhat tired the nerves controlling the hands as well as the legs. This illustrates the fact that any fatigue tires all the musculomotor nerve centers. The blood pressure and pulse tests will show that any fatigue, mental as well as muscular, also tires the whole vasomotor as well as the musculomotor system. These facts explain why any kind of fatigue may aggravate any disease whatever, because the weakest cells give out most.

From the segmental standpoint, it is obvious that even if a man is *generally* able to do his usual work, the weak segments may not be. Consequently, a man with chronic sciatica should not work each day until the pain becomes intolerable, if he expects the weakest nerves to catch up to the others.

Nervous Tension a Warning

Intense mental or even moderate mental or physical effort

may so stimulate the heart and the vasomotor nerves as to accelerate the circulation and make a temporary improvement of chronic or even acute symptoms. This, however, does not prove that the trouble is mental, even if the pain returns when the patient ceases his activity. The improvement in the circulation during the exertion explains the temporary relief from pain. If the patient is vigorous enough to maintain an active outdoor life, the improvement in circulation will cure many troubles, but if the exertion tires the patient too much any disease will be aggravated.

Physical culture, like all procedures which improve the general health, also improves the condition of the weakest spinal segments in proportion, but *only* in proportion. The results depend on how much the weakest segments can endure. Fatigue may act as a stimulant for a limited time. It increases the already excessive irritability of all nerve cells, maintaining a rapid circulation and a greater muscular tone, but the inevitable reaction must come as from any form of stimulation. This is the cause of many nervous collapses. Increasing irritability and nervous tension should be regarded as a serious warning. Otherwise a surgical operation or going to a sanitarium will be the result.

To be uniformly strong it is obvious that it may be necessary for some people to take extra rest until the weakest nerve cells catch up with the stronger, because all fatigue affects all of the nerve cells and usually the weakest chiefly.

Mental exertion, hunger, high temperature, marked humidity, and low atmospheric pressure all diminish muscular energy.

"A man or horse works better when he is well fed, and feeds best when he is well worked." Well-to-do Germans ate seven meals a day. Napoleon is supposed to have said that "a soldier fights on his belly." Consequently the low proteid diet is not a panacea, for if one's income of nutrition is less than his requirements, no treatment or regime can strengthen fatigued nerves.

However, when a man is thoroughly tired it is unreasonable to expect his stomach to digest a hearty meal. At such a time

he lacks the nervous power to carry on the digestive operations, hence the frequency of indigestion in weakened nervous conditions. It requires perhaps five-sixths of one's total physiological income to maintain the vital functions. Any degree of flatulence may follow fatigue; and flatulence by its pressure always affects the circulation, and since the heart action and general blood pressure are largely controlled by the abdominal vasomotor mechanisms, it is easy to understand the chain of serious and even fatal cardiac, cerebral, and other symptoms which may follow indigestion and fatigue.

It would be superfluous to say anything in favor of physical culture, for exercise is the natural and necessary method of maintaining a rapid circulation, which supplies the maximum nutrition to every cell in the body. Incidentally, vigorous exercise relieves all the local anemias or hyperemias of the cord and brain, which cause chronic functional disturbances of any part of the central nervous system; but if a patient is too weak it is very easy to exhaust the already fatigued nerve centers.

It is recognized that in case of organic disease of the cord, exercise should always stop short of fatigue. In organic disease of the cord the nerve cells are weakened or are undergoing degeneration, and if they are overworked they will be injured. This is quite as true, to some extent, of any condition where the nerves are weak.

Overwork and Irritable Nerves

The strongest men must live within their physiological income, and if the nervous system has become fatigued and irritable, locally or generally, the income of nervous strength must be increased or the expenditure cut down, or both. Reasonable amounts of food, sleep, fresh air, and diversion (which uses another part of the brain) reduce nervous irritability; fatigue, malnutrition, excitement, or anything else which disturbs the circulation, ultimately increases nervous irritability. The immediate effect of fatigue of a normal nerve cell is to reduce its quickness and strength of response to stimulation, but just as excessive fatigue sooner or later increases the irritability of

brain cells, so also fatigue or starvation (either from insufficient nutrition or a depressed circulation) increases the irritability of all nerve cells in the spinal cord.

When a rising blood pressure reaches a certain point, the heart, kidney, or some part of the central nervous system must give way. Losing a little sleep every night may cause no trouble until after years. Most people who would hesitate to lose a meal will never think of trying to make up lost sleep. They see no injurious results immediately and there may be twenty years between a faulty premise and its inevitable conclusion. Since fatigue increases nervous irritability and sleep reduces it, there is no great difficulty in accounting for "Americanitis." The effects of working overtime are not confined to the so-called "nervous" troubles; any disease or physical disorder of any kind is aggravated by fatigue, and one's rate of recuperation from, or resistance to, any acute illness depends on the amount of previous fatigue. No one can spend the day in work and part of the night in pleasure seeking, without paying the inevitable penalty. The attractive sophistry that one must have diversion at any cost has ruined many. No amount of diversion can take the place of rest, and if it involves a loss of sleep, it may be just as injurious to drive the nervous system to a greater collapse by means of such excitement as by any drug stimulant. Diversion should be taken out of working hours and not out of resting hours.

Diversion may be more fatiguing than work. Many people have acquired nervous prostration from bridge whist. It is not simply overwork which is responsible for the modern nervous fatigue. Going without necessary sleep, very often for the purpose of going to the theater or for other pleasure seeking, may be responsible. "All work and no play" may not be desirable, but no amount of diversion can take the place of sleep or prevent "Jack" from becoming dull.

Practicing on the piano, which is a great nervous strain, has been responsible for much nervous exhaustion; whereas, singing is an excellent form of exercise, and beneficial to the health.

Effects of Fatigue on the Circulation

The effects of fatigue on muscles and on musculomotor nerve cells have been carefully studied by the ergograph and other methods, but the effects of fatigue on the vasomotor nerves are not so well understood. Even in so obvious a case of musculomotor fatigue as writer's cramp, the vasomotor fatigue is a most (and perhaps the most) important factor; because a musculomotor nerve cell, when fatigued, will recover by rest if the vasomotor conditions are normal, and the cells have therefore the normal rate of income of nutrition. If, however, there is a marked vasomotor disturbance, in addition to the musculomotor fatigue, one may wait indefinitely, perhaps for years, and not recover from the effects of overwork. This applies to all symptoms which persist after overwork, severe illnesses, or shocks, whether physical or mental.

If the vasomotor system is generally fatigued, even so apparently an anatomical condition as arthritis may develop, if the vasomotor nerves to the joints happen to be sufficiently weak. And if the general blood pressure continues low, one may wait indefinitely, and most forms of treatment only aggravate the vascular relaxation. In this condition any fatigue, even too much talking, may aggravate the arthritis. If there is a general hypotension of vessels from fatigue, is it any wonder if the blood vessels of the joints dilate also, causing arthritis, or if the vessels of the nerve trunks, causing neuritis, or if the vessels of the muscles, causing the infiltration of rheumatism? Similarly, fatigue will aggravate any condition whatever, because it weakens the vasomotor nerves, on whose uniform activity the vitality and recuperative power of every tissue in the body depend.

The subject of fatigue is of vital importance, and if we ignore the effects of fatigue and treat symptoms entirely from the standpoint of auto-intoxication and uric acid, which are not the causes of vascular variations, it hopelessly misdirects the attention. When neuritis, as is frequently the case, results from fatigue, the use of morphine and similar drugs introduces a frightful danger. Alexander Lambert, Professor in Cornell

University, in the "J. A. M. A.," June 21, 1913, says that 80 per cent of all the drug "fiends" in the country, with all the suffering for their families as well as for themselves which this represents, are the result of prescriptions. Therefore to ignore the warning which pain is intended to give and persistently relieve the pain with some anodyne is a frightful blunder.

Blood Pressure and Fatigue

Still more serious, perhaps, is the mistake of ignoring the fact that fatigue steadily raises the blood pressure of those whose blood pressure is already above normal. As a result "arteriosclerosis" is becoming a common cause of death among the strongest and most active business and professional men, even of middle life. If the hardening is attributed to toxins, instead of being recognized as the necessary result of fatigue of the vasomotor nerves, which increases their irritability and therefore the contraction of the arterial muscles, the patient is allowed to go on to destruction.

Whether or not the rise in blood pressure is sufficient to cause degeneration of the arterial walls, the rise in resistance to the work of the heart gradually impairs the nutrition of all nerve cells and so increases their irritability, until the vicious circle reaches the point where the circulation is simply throttled. Thus nervous irritability may be the limit to life, even if the immediate cause is the giving out of the heart or the kidneys or the brain from the high pressure.

Similarly, fatigue is the cause of much of the ever-increasing irritability of the visceromotor nerves which control all involuntary muscles, producing, on some exposure to cold, contractions and dilatations of any part of the alimentary tract, from the throat to the lower bowel, and these contractions may then be the occasion of all kinds of otherwise unnecessary operations, *e.g.*, contractions of the pylorus, appendix, or sphincter ani. Chiefly, perhaps, fatigue causes all forms of mental disturbance by overworking the brain cells directly and also by depriving them of their normal nutrition by the coincident circulatory

disturbances, resulting from the simultaneous fatigue of the vasomotor nerves.

The Physical Nature of Nervous Trouble

Because fatigue is not sufficiently recognized as a cause of nervous troubles, thousands of the hardest working business men who began to develop abnormal feelings and ideas have been told to "forget it" and "cheer up," until something worse developed. An abnormal idea may be just as definite a physical warning as the pain of neuritis. But because some, usually slight, physical ailments have been cured by will power, the "effect of mind over body" is being so emphasized that an incomparably greater number of people are ruining their health by "will power" than those who have been cured; and those who are killed are the most active, most successful, and most useful men in the community. The feeling of apprehension or fear which may be the first mental symptom of anemia of the brain, instead of being disregarded should be considered as much a physical symptom as pain in rheumatism, and should be a warning to make the patient live a more hygienic life.

Fatigue symptoms and sensations are usually attributed entirely to waste products in the blood stream. However, it often can be demonstrated upon a person who is tired and whose blood pressure is too high, and whose grip is weak when tested by the dynamometer, that as soon as a treatment has improved the rate of flow of the blood, the blood pressure not only drops but the patient feels more rested and the grip is stronger at once.

These changes will often occur before sufficient time has elapsed to change greatly the quality of the blood, and are the result of restoring the normal rate of flow.

A Suggestive Analogy

"We make guilty of our disasters the sun, the moon, the stars, as if we were fools by necessity (overworked) by heavenly compulsion (nervous wrecks) by spherical predominance."—Shakespeare.

It is an exact and suggestive analogy to compare the collapse

of the nervous system, which is a social cell community, to some great social and political upheaval like the French Revolution. The amount of energy in a man or in a cell body of the central nervous system is definitely limited; therefore, if the rulers and aristocracy (the will) persistently overwork and overtax the common people (the subordinate nerve centers), the abuse will be patiently borne for a time, but ultimately "chaos will arise."

At first there will be small insurrections (premonitory symptoms, languor, headache, indigestion, irritability), suppressed with greater and greater difficulty, either by coercion (stimulants) or by compromise and promise (sedatives). But this cannot avert the inevitable retribution; nay, more, it can only increase the final catastrophe. At last, when the limit of endurance is reached, chaos arises.

All now in confusion, "preternatural suspicion," a "reign of terror" (hysterics, melancholia, phobias, etc., the will no longer completely controls the emotions and activities), "chaos *has* arisen" and takes vengeance on the aristocracy for an infinite succession of abuses.

And the remedy—compromise, palliation? Never! If the new government (the convalescent nervous system) after its loss of prestige (and morale) weakens (becomes fatigued for a moment), instantly anarchy reasserts itself. We must have the whiff of grapeshot, radical measures, an ironclad system of laws (of health) which alone can restore order out of chaos.

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